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Exposure Testing of Hycrete Concrete Additive in a Wastewater Treatment Environment

Final Report on Project F09-AR05B

Steven C. Sweeney

May 2017



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Exposure Testing of Hycrete Concrete Additive in a Wastewater Treatment Environment

Final Report on Project F09-AR05B

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Final report

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Under Project F09-AR05B, "Integral Waterproofing for Concrete Structures Research,
Development, Evaluation and Demonstrations at IMCOM Facilities"

Abstract

The corrosion of reinforced concrete in wastewater systems is a costly on-going problem for the Department of Defense (DoD). Capillary action makes concrete vulnerable to penetration by highly corrosive chemicals transported by wastewater. Progressive corrosion of embedded steel reinforcement greatly increases internal stresses on the concrete, ultimately causing premature fractures and spalls. Researchers hypothesized that corrosion in such aggressive environments could be mitigated using a hydrophobic concrete admixture to inhibit penetration of corrosive liquids into wastewater treatment infrastructure, thereby reducing stresses on the materials and extending service life. This study tested and evaluated one such admixture, a patented material called Hycrete.

This evaluation exposed test coupons within the sewage effluent system at Fort Detrick, MD. Under the two year duration of this test, the presence of Hycrete had no noticeable influence on performance of concrete exposed to sewer effluent or gasses. Visual appearance did not dramatically differ and there were no significant changes chemical composition. The results suggest that neither the Hycrete nor the reference concrete specimens were affected by chemical leaching or intrusion during the two-year demonstration period. The return on investment for this effort was, therefore, zero.

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Preface

This demonstration was performed for the Office of the Secretary of Defense (OSD) and U.S. Army Installation Management Command (IMCOM) under Department of Defense (DoD) Corrosion Prevention and Control Project F09-AR05B, “Integral Waterproofing for Concrete Structures Research, Development, Evaluation and Demonstrations at IMCOM Facilities”; and Military Interdepartmental Purchase Requests MIPR9ACERL1043 (FY09) and MIPR10005161 (FY10). The proponent was the U.S. Army Office of the Assistant Chief of Staff for Installation Management (ACSIM), and the stakeholder was IMCOM. The technical monitors were Daniel J. Dunmire (OUSD(AT&L)), Bernie Rodriguez (IMPW-FM), and Valerie D. Hines (DAIM-ODF).

The work was performed by the Materials and Structures Branch of the Facilities Division (CEERD-CFM), U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL), Champaign, IL. The laboratory testing was performed by Tourney Consulting Group, Kalamazoo, MI. At the time this report was prepared, Vicki L. Van Blaricum was Chief, CEERD-CFM; Donald K. Hicks was Chief, CEERD-CF; and Kurt Kinnevan, CEERD-CZT, was the Technical Director for Adaptive and Resilient Installations. The Deputy Director of ERDC-CERL is Dr. Kirankumar Topudurti and the Director is Dr. Ilker Adiguzel.

The Commander of ERDC is COL Bryan S. Green and the Director is Dr. David W. Pittman.

1 Introduction

1.1 Problem statement

The corrosion of reinforced concrete in wastewater systems is a costly ongoing problem for the Department of Defense (DoD). Because concrete is a porous material, capillary action makes it vulnerable penetration by water and highly aggressive chemicals. Progressive corrosion of embedded steel reinforcement greatly increases internal stresses on the concrete, ultimately causing premature fractures and spalls. DoD spends about \$7 million annually to repair damage caused by this type of corrosion on military installations (Herzberg, O'Meara, and Stroh 2014, p N-17).

One approach to preventing or controlling corrosion of sewage and wastewater infrastructure is to design high-performance concrete mixes that are less permeable to intrusion by liquids. One approach is to include densifiers such as silica fume in the mix. Silica fume is very effective, but it can be expensive, and in hot environments it can cause shrinkage cracking. A newer approach is available through the use of a patented hydrophobic admixture that is claimed by the manufacturer to prevent water intrusion into reinforced concrete, thereby protecting the embedded reinforcement steel from exposure to water and corrosion-promoting chemicals it may contain. To investigate the efficacy of this concrete admixture, which is called Hycrete,* two related demonstration/validation projects were performed under the auspices of the DoD Corrosion Prevention and Control Program. One project, designated F09-AR05A, was initiated to investigate the efficacy of Hycrete added to the concrete mix for an ocean-front seawall at an Army facility in a highly corrosive, chloride-infused environment (Sweeney and McInerney 2017). The other project, designated F09-AR05B, is documented in the present report. This work, supported through funding from the U.S. Army Installation Management Command (IMCOM), consisted of laboratory testing of concrete specimens exposed to a wastewater-treatment chemical environment. The test specimens were made from concrete mixes with and without Hycrete to compare the performance of the demonstrated admixture.

* Hycrete is a trademark of Hycrete, Inc., <http://www.hycrete.com/>.

1.2 Objective

The objective of this test program was to determine whether the use of Hycrete in reinforced concrete wastewater transport and treatment systems can reduce the amount of aqueous and gaseous corrosive chemical species absorbed by the concrete and, thereby, reduce the potential for corrosion-related degradation and associated maintenance costs for DoD.

1.3 Approach

The testing program was executed for ERDC-CERL by Turney Consulting Group, Kalamazoo, MI. The test site was the wastewater treatment facility at Fort Detrick, MD, which was identified as a representative facility for the testing parameters. The specific location within the treatment facility was selected on the basis of scheduling, access, and other logistical considerations.

A total of 96 test specimens (48 references and 48 prepared with Hycrete) were fabricated. The experiment was planned to provide three exposure conditions: below the water line, partially submerged, and above the water line. The coupons were mounted at a location within the system near the effluent tank. After exposures of 6, 12, 18, and 24 month, 12 reference samples and 12 Hycrete samples were removed and tested for the presence of corrosion-promoting compounds.

1.4 Metrics

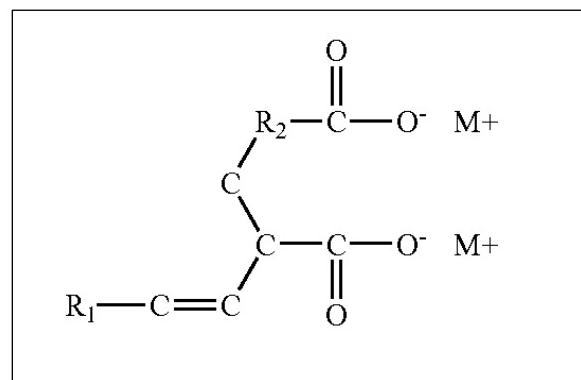
Performance of the Hycrete additive was assessed by comparing the chemical composition and pH of the Hycrete specimens to the reference specimens at intervals of 6, 12, 18, and 24 months. Of specific interest for these tests were two chemical compounds common to wastewater treatment plants that have a deteriorating effect on concrete: sulfur trioxide and phosphate (as pentoxide). The metric for success of the demonstrated additive was an observed lower rate of absorption of these chemicals by the Hycrete specimens than the standard concrete ones. The absorption data would be used to estimate the relative service lives of the compared materials.

2 Technical Investigation

2.1 Technology overview

The composition of Hycrete includes a proprietary aqueous solution of an alkali salt of a dioic acid. As shown in Figure 1, M^+ is selected from the group that consists of Na^+ and K^+ . R_1 and R_2 represent the linear aliphatic hydrocarbons within Hycrete. In an attempt to prevent the active ingredient in Hycrete from precipitating, the molecules include each of the alkali metal constituents Na^+ (90–95%) and K^+ (5–10%) (Rhodes et al. 2007).

Figure 1. Chemical composition of Hycrete.



When added to a concrete mix, Hycrete uses water within the concrete to migrate to the anodic surface of the reinforcing steel. One of the molecular ends uses its polarity to protect the positively charged anode of the reinforcement during the corrosion process. The reinforcement in concrete attracts the hydrophilic end of the additive. Once the additive reaches the surface of the reinforcement it adheres to the iron in the reinforcement material to form a slightly soluble hydrophobic layer. This layer helps to protect the anode potential of steel from chlorides, sulfates, carbon dioxide, oxygen, and moisture.

In an aqueous solution, Hycrete reacts with metallic or other ions it encounters in the concrete or the reinforcement. These reactions form molecules that have long, hydrophobic hydrocarbon chains with limited water solubility. These hydrocarbon chains fill the capillaries, cracks, and fissures of the post construction structure and help to repel water and prevent or reduce the capillary absorption of moisture (Rhodes et al. 2007).

2.2 Field work

A total of 96 specimens (48 reference coupons and 48 containing Hycrete) were fabricated. On or about 25 October 2011 the specimens were inserted into or near the effluent tank at Fort Detrick. For each group of 48 specimens, 12 were placed below the wastewater level, 12 were approximately halfway submerged, 12 were suspended above the wastewater level, and 12 were placed at the site, away from the effluent tank, for exposure to normal weathering.

At 6, 12, 18, and 24 months after initial exposure (approximately mid-April 2012; mid-October 2012; mid-April 2013; mid-October 2013), 24 specimens—3 specimens of each concrete type and location—were removed for testing. The specimens were removed, rinsed with tap water, and placed in zip-seal plastic bags clearly marked with concrete type (i.e., reference mix or Hycrete) and exposure conditions (above, at, or below water line, or normal weathering). The specimens were then shipped to the testing lab for analysis.

2.3 Testing and analysis

At the laboratory, the specimens were photographed and chemical tests on each specimen were conducted. At the three depth increments (0 – 0.125 in.; 0.125 – 0.25 in.; and 0.25 – 0.375 in.), the concentrations of sulfur trioxide and phosphate (as pentoxide) were tested. The analysis was performed via x-ray fluorescence (XRF). Based on the strength of the experimental design, the test results were expected to be quantitatively accurate and repeatable. The hypotheses were that sulfur trioxide would be stripped out of the concrete if the sewage were attacking the concrete; and that phosphate content would increase if sewage was penetrating the concrete during exposure.

The Appendix of this report presents the contractor's final report on the testing program, including photographs, data, analysis, and conclusions.

3 Results

As stated in the TCG final report on the testing program (see Appendix), the presence of Hycrete in the concrete specimens had no noticeable influence on the performance of concrete exposed to sewer effluent and/or gases over the duration of the testing period for this project. The visual appearance of the reference and Hycrete concrete test specimens was not dramatically different. Concrete pH was not impacted during the exposure period, and there were no sizeable changes in chemical composition. These results suggest that no significant leaching of chemicals from specimens of either type occurred during the exposure period. Complete test results are shown in the Appendix.

4 Economic Summary

4.1 Costs and assumptions

No initial return on investment calculation was required by the sponsor for this portion of CPC Project F09-AR05. All work on this portion of the project was performed under contract at a total cost of \$170,853.

The research hypothesis was that use of Hycrete in a concrete mix intended for constructing a wastewater treatment system would reduce the degradation of concrete and steel caused by the liquid-borne penetration of highly corrosive chemicals. Any extended concrete service life that could be validated through the testing program would result in a positive return on investment.

4.2 Projected return on investment (ROI)

The results of this testing showed no significant improvement in the performance of the specimens treated with Hycrete versus the untreated specimens. Due to the project design, especially the limited coupon exposure time and differences between how the coupons were exposed versus concrete exposure in a real-world wastewater treatment facility, the results are considered to be inconclusive. Consequently, the ROI for this effort was determined to be zero.

5 Conclusions and Recommendations

5.1 Conclusions

The results of this study demonstrated no observed benefits related to the use of Hycrete to reduce the permeability of concrete to aggressive aqueous chemical species found in wastewater treatment systems. However, the two-year duration of the testing program represents potential limitation of the study in terms of the possible time required for Hycrete performance benefits to become clear. Because the results of this study must be considered inconclusive, the project produced a zero return on investment.

These results do not address any other benefits attributed to the use of Hycrete by the manufacturer or other independent testers.

5.2 Recommendations

Because the results of this testing program were inconclusive, ERDC/CERL offers no recommendations about the applicability of Hycrete in wastewater treatment systems and, therefore, offers no recommendations pertaining to DoD implementation of the product.

References

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- Sweeney, Steven C., and Michael K. McInerney. 2017. *Investigation of Hydrophobic Concrete Additive for Seawall Replacement at Pilalau Army Recreation Center, Hawaii: Final Report on Project F09-AR05A*. ERDC/CERL TR-17-10. Champaign, IL: ERDC-CERL.

Appendix: Tourney Consulting Group Final Report on Hycrete Testing at Fort Detrick, MD

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Waste Water Treatment Hycrete Testing @ Fort Detrick

Prepared for:
Mandaree Enterprise Corporation
Order Number: W9132T-TCG-002
Prime Order: 10-D-0007-0008

December 27, 2013
TCG # 10126

Report Prepared by:
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Introduction/Overview:

Tourney Consulting Group (TCG) is pleased to present this report summarizing the laboratory testing results related to the evaluation of concretes (with and without a waterproofing admixture) exposed to a sewer environment. Concrete was cast approximately 2 years ago. Half of the specimens were a conventional concrete (Control). Half of the specimens contained Hycrete but were of the same concrete mix design, proportions, and materials as the control. The test series consisted of 4 unique exposure conditions: 1) A location near the sewage effluent tank but not exposed to sewage or gases; 2) submerged in the sewage effluent tank; 3) suspended at the “water line” (partial submerged/partially above) of the sewage effluent tank; and 4) suspended above the high water level of the sewage effluent tank. Note: The tank used for this experiment is a large open topped effluent tank located at Fort Detrick, Maryland.

Sewage and sewer gasses are very aggressive and have historically resulted in deterioration of concrete that is exposed to sewage and/or gasses. This phenomenon has been well documented and researched. Generally, it is theorized that if the concrete can be made less permeable, the effect of the sewage and/or gasses can be lessened. This is often accomplished via higher performance mix designs or the inclusion of densifiers, such as silica fume. Hycrete is a “water proofing” additive that slows the ingress of moisture; this mechanism (slowing ingress of moisture and hence “aggressive materials”) may have promise to lessen the degradation of concrete in harsh environments, such as sewers.

It should be noted that while sewage can be aggressive, the most pronounced degradation occurs when sewer gases are trapped in an enclosed space (such as the free space above the linear flow of sewage in a pipe). This is a bacterially mediated process which forms hydrogen sulfide gas and then subsequently converts to form sulfuric acid (by sulfur oxidizing bacteria) that attacks concrete. This “classic” sewer condition could not be duplicated given the configuration of the sewage tanks at the Fort Detrick location. Hence, the “above” sewage and “partially submerged” conditions do not represent the common exposure conditions associated with sewers.

The scope of TCG’s work was to perform laboratory testing specifically photography, determination of pH, and chemical analysis of the concrete. One-quarter of the specimens were removed from the various exposure conditions every 6 month (after exposure lengths of 6-month, 12 months, 18-months, and 24 months) for destructive testing. Reports have been issued after each destructive testing cycle. This report represents the 24-month data set and is the final report for this task order.

Project Background

The technical leads for the project agreed that at the 6, 12, 18, and 24 month intervals for sampling/analysis the following would be the testing approach: At the three depths increment: 0"-1/8"; 1/8" – ¼"; and ¼" – 3/8"), the concentration of sulfur trioxide and phosphate (as pentoxide) were tested. The analysis was performed via XRF. Given the novelty of this experimental design, it was felt that this will be highly quantitative and repeatable. It was theorized that sulfur trioxide would be “stripped out” of the concrete if the sewage was “attacking” the concrete. Conversely, phosphate would increase if sewage was leaching into the concrete during exposure. Note: Given the nature of

XRF analysis, concentrations of several additional materials were also determined. These are reported as well.

The test site was the Fort Detrick Water Treatment facility. The overall project schedule was subject to site availability aspects associated with construction at the test site. A kick-off, site inspection occurred on March 21st, 2011 where the overall project scope and direction was reviewed with the team. In addition, several possible exposure site conditions were examined and assessed. It was mutually decided by all parties that the test area should be selected based on logistical and operations issues. There did not appear to be any tank locations that would be exceptionally well suited or poorly suited for the experiment. Therefore, there was not a technical recommendation as to location of the specimens. The location was selected based on ease of access, consistency of liquid level, and to minimize interference with plant operations.

A total of 96 specimens (48 references + 48 containing Hycrete) were fabricated. These specimens were cast (under the supervision of Hycrete personnel) in the summer of 2011.

The main focus of the test program was to assess the performance of the concrete specimens when exposed to effluent. During the site visit, TCG, in consultation with the other team members, agreed that a racking or similar system would be overly complicated and would limit the possible locations where the test could be conducted and possibly interfere with plant operations. Instead, the test procedure was to cast a rugged hook/loop or embedded anchoring point in the top of each cylindrical specimen from which the specimens can be suspended from a chain, wire or similar at varying heights that correspond to the exposure conditions outlined in the RFP. The chains, wire or similar were fastened to the top edge of the effluent tank or anchored as appropriate based on site restrictions and as designed and installed by MEC. It is important that there is the ability to periodically remove or inspect specimens during the course of the test. As agreed by all parties, a simple approach that exposes the specimens to the prescribed conditions is desired and will be accomplished by this proposed method.

Specimen Configuration

On or about October 25th, 2011, the specimens were inserted into the effluent tank. The specimens are organized as follows:

- 48 Reference Specimens
 - 12 below the waste water level
 - 12 at the mean waste water level (approximately ½ of the specimen length above approximately ½ of the specimen length below)
 - 12 above the waste water level but still in close proximity
 - 12 stored at the test facility but removed from the immediate test structure and exposed to normal weathering
- 48 Hycrete Specimens
 - 12 below the waste water level
 - 12 at the mean waste water level (approximately ½ of the specimen length above approximately ½ of the specimen length below)

-
- 12 above the waste water level but still in close proximity
 - 12 stored at the test facility but removed from the immediate test structure and exposed to normal weathering

TCG personnel observed the installation of the test specimens and provide a recommended location for the specimens that will be stored at the test facility but removed from the immediate test structure location. The specimens on site but not in the test structure should be clearly identified with "Test Specimens – Do Not Move."

QC Monitoring:

While the bulk of the subsequent test effort is related to chemical testing, there were some periodic QC inspections that were performed on-site by local and/or MEC personnel to ensure test program integrity. These were conducted between the sampling increments described below (months 3, 9, 15, 21) and consisted of:

- Visual inspection of the specimens on site but not in the test structure to ensure they have not been disturbed or removed. Any issues should be reported to MEC.
- Visual inspection of the specimens within the effluent tank to ensure the hook/loop or embedded anchoring point; as well as the chain, wire or similar has not been compromised by exposure to the effluent. Any issues should be reported to MEC.
- Identify (count) any specimens which have fallen to the tank bottom. Any issues should be reported to MEC.
- Monitor the effluent levels within the tank to assess if specimen levels require adjustment to maintain the prescribed exposure conditions.

Periodic Testing at TCG

At 6, 12, 18, and 24 months after initial exposure, specimens were removed for testing. At each time period (approximately mid-April 2012; mid-October 2012; mid-April 2013; mid-October 2013), the following specimens were pulled from the test site:

- 12 Reference Specimens
 - 3 from below the waste water level
 - 3 from at the mean waste water level (approximately $\frac{1}{2}$ of the specimen length above approximately $\frac{1}{2}$ of the specimen length below)
 - 3 from above the waste water level but still in close proximity
 - 3 from the area at the test facility but removed from the immediate test structure and exposed to normal weathering
- 12 Hycrete Specimens
 - 3 from below the waste water level
 - 3 from at the mean waste water level (approximately $\frac{1}{2}$ of the specimen length above approximately $\frac{1}{2}$ of the specimen length below)
 - 3 from above the waste water level but still in close proximity

-
- 3 from the area at the test facility but removed from the immediate test structure and exposed to normal weathering

The specimens were removed, rinsed with potable water, and individually sealed in ZipLoc (or similar) storage bags that are clearly marked with concrete type (Reference or Hycrete) and exposure conditions (above, at, or below water line or offsite). The specimens were then shipped to TCG's Kalamazoo's offices for analysis.

Upon sample receipt, TCG photographed and conducted chemical tests on each specimen. TCG determined (individually) Ammonia and Phosphate content profile at three (3) unique depth increments per specimen. Depth increments were: [surface to 1/8"], (1/8" to 1/4"), [1/4" – 3/8"]). In addition, TCG will determine the pH at three (3) unique depth increments per specimen: [surface to 1/8"], (1/8" to 1/4"), [1/4" – 3/8"]).

Conclusions: It would not appear that the presence of Hycrete had a noticeable influence on performance of concrete exposed to sewer effluent and/or gasses. Visual appears was not dramatically different, pH was not impacted during exposure, and there were not sizeable changes chemical composition suggesting that neither the Hycrete and references concretes had materials leech in our out during exposure.

Lab Test Results - Photographs

6 Months

6 Months: Controls / No Exposure:



TCG TOURNEY CONSULTING
Mandaree Enterprise Corporation
Ft. Detrick Wastewater Treatment
C Dry-1 tie-White
TCG#10126 Received May 2012

6 Months: Hycrete / No Exposure



TCG TOURNEY CONSULTING
Mandaree Enterprise Corporation
Ft. Detrick Wastewater Treatment
H Dry-1 tie-Black
TCG#10126 Received May 2012

6 Months: Controls / Above Water Line



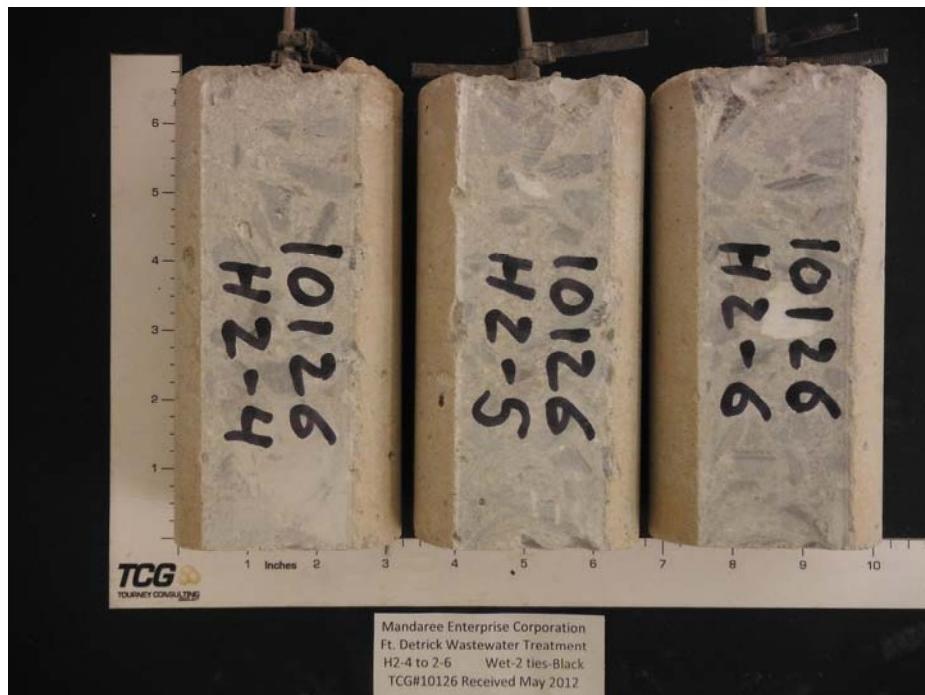
6 Months: Hycrete / Above Water Line



6 Months: Controls / Partially Submerged



6 Months: Hycrete / Partially Submerged



6 Months: Controls / Submerged



6 Months: Hycrete / Submerged

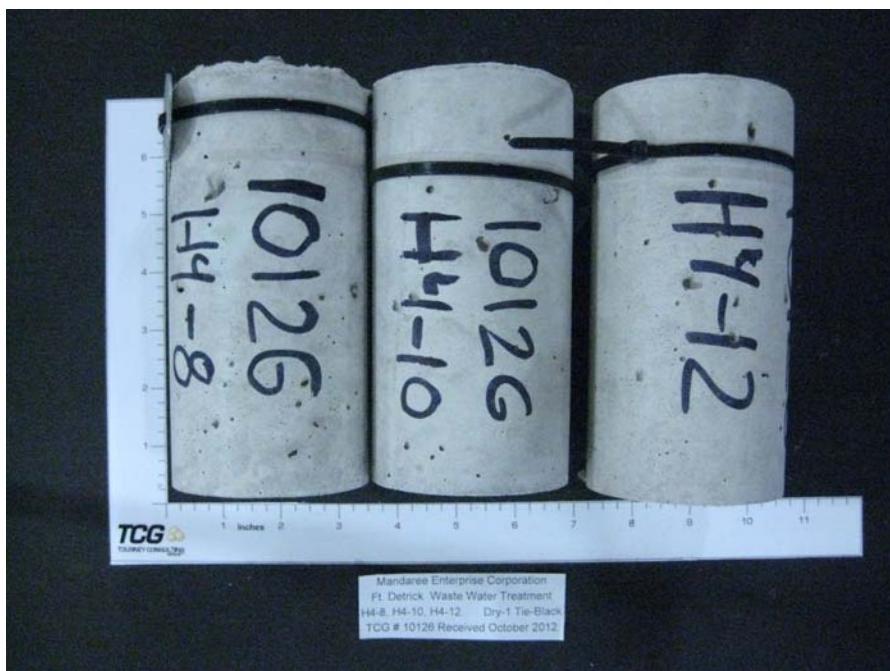


12 Months

12 Months: Controls / No Exposure



12 Months: Hycrete / No Exposure



12 Months: Controls / Above Water Line



12 Months: Hycrete / Above Water Line



12 Months: Controls / Partially Submerged



12 Months: Hycrete / Partially Submerged



12 Months: Control / Submerged



12 Months: Hycrete / Submerged



18 Months

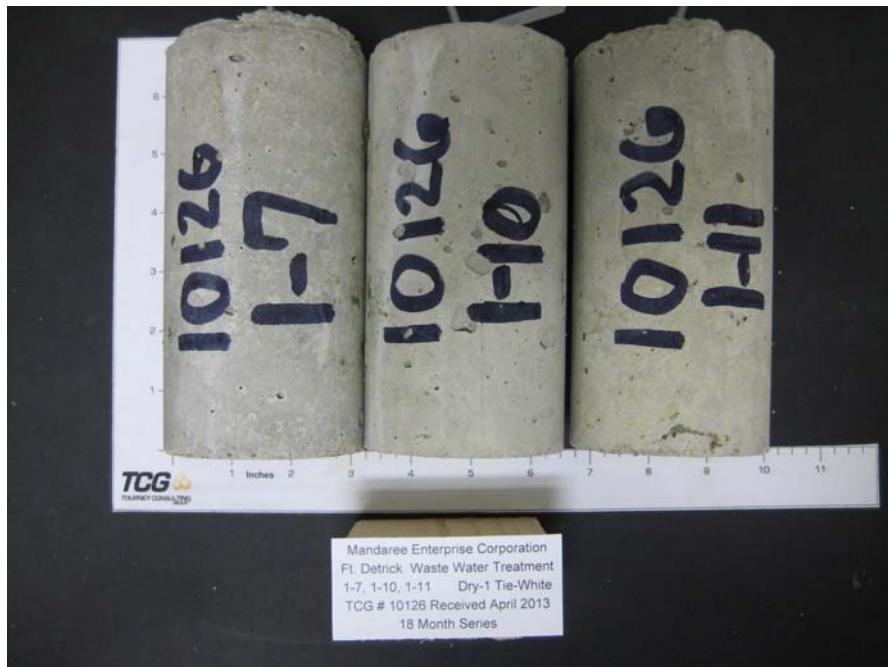
18 Months: Controls / No Exposure



18 Months: Hycrete / No Exposure



18 Months: Controls / Above Water Line



Mandaree Enterprise Corporation
Ft. Detrick Waste Water Treatment
1-7, 1-10, 1-11 Dry-1 Tie-White
TCG # 10126 Received April 2013
18 Month Series

18 Months: Hycrete / Above Water Line



Mandaree Enterprise Corporation
Ft. Detrick Waste Water Treatment
H1-7, H1-10, H1-11 Dry-1 Tie-Black
TCG # 10126 Received April 2013
18 Month Series

18 Months: Controls / Partially Submerged



18 Months: Hycrete / Partially Submerged



18 Months: Hycrete / Partially Submerged



18 Months: Control / Submerged

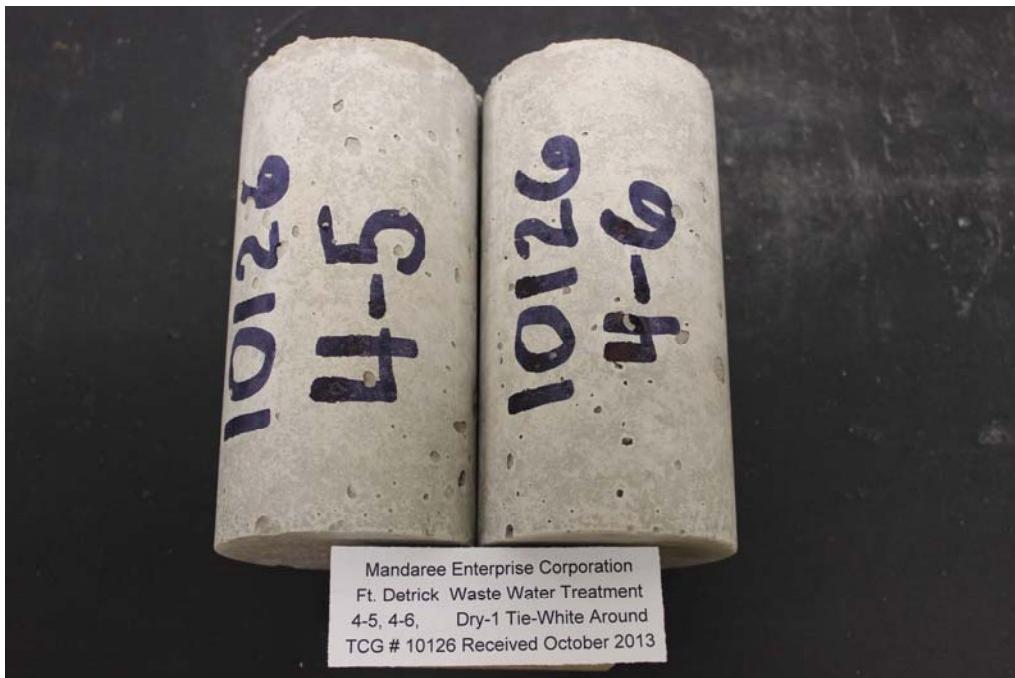


18 Months: Hycrete / Submerged

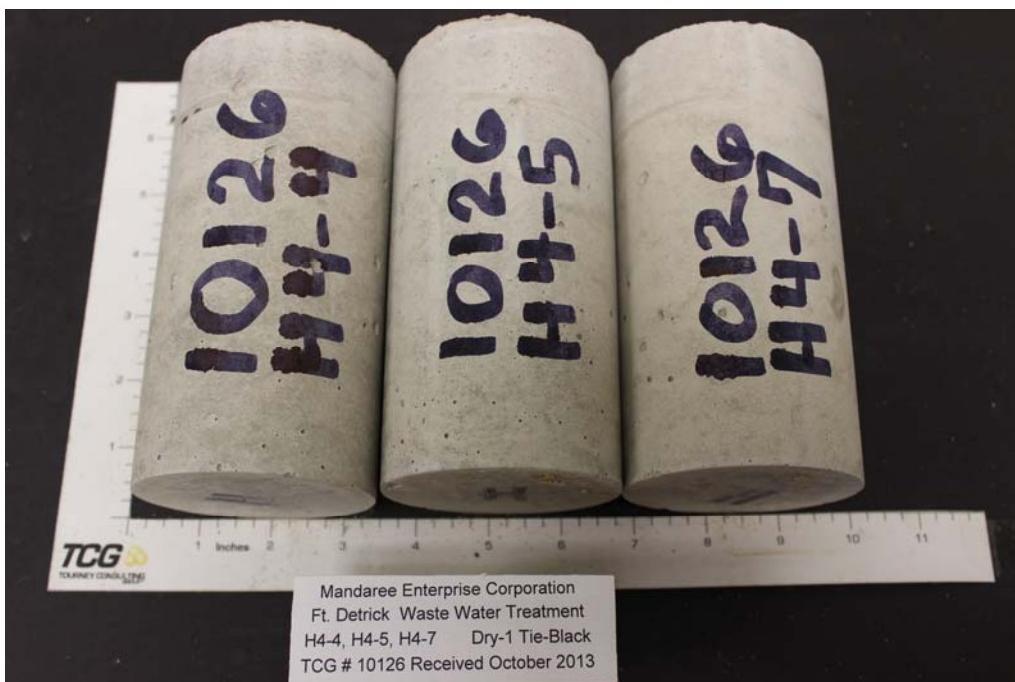


24 Months

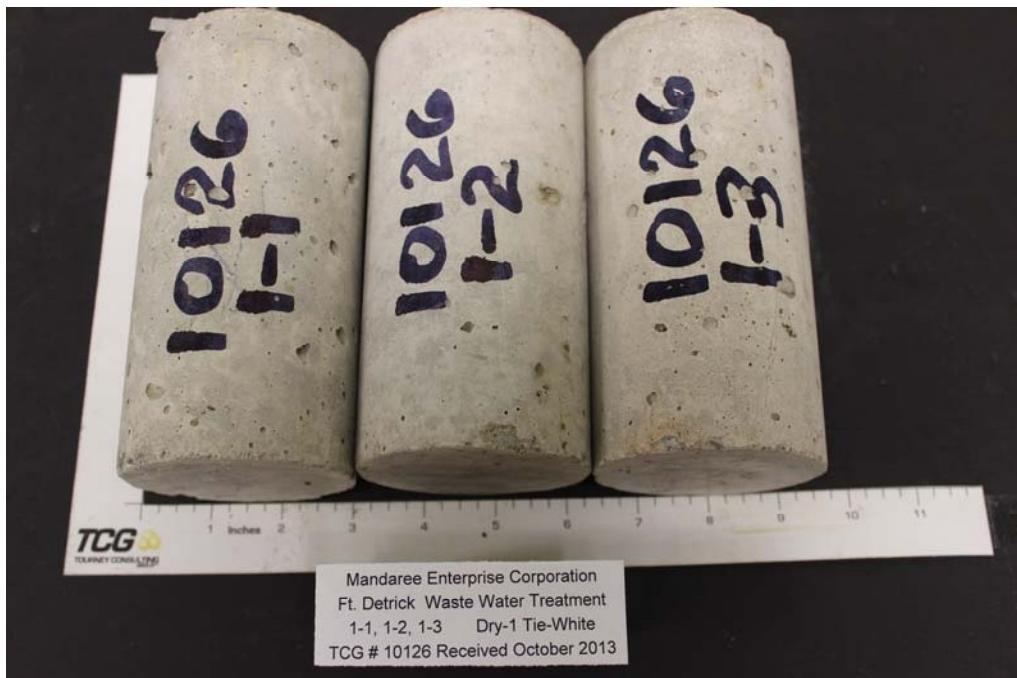
24 Months: Controls / No Exposure



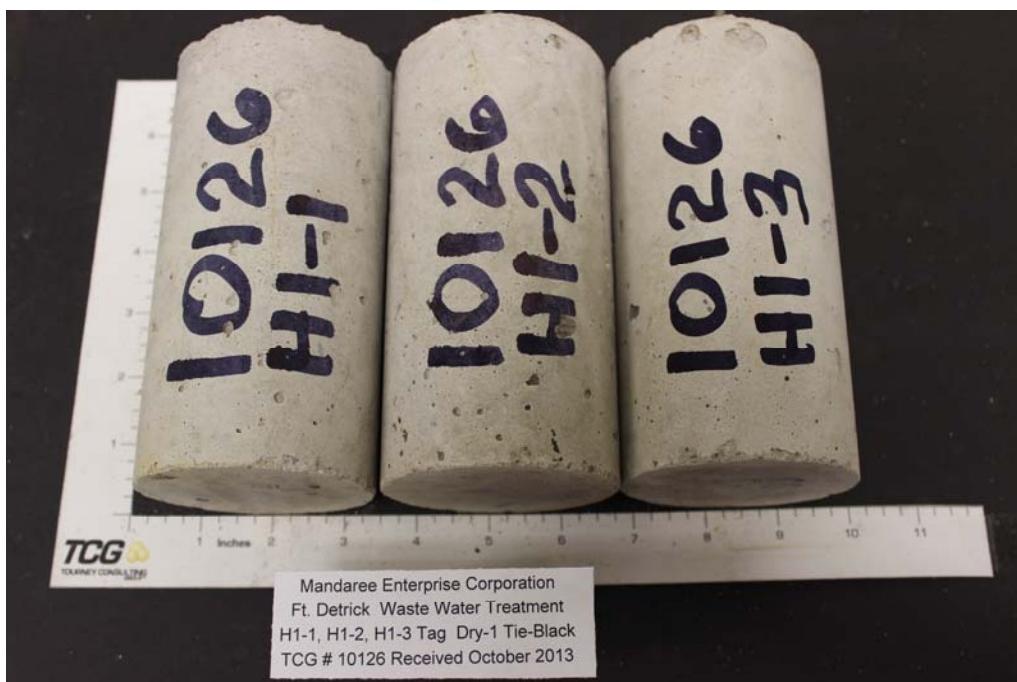
24 Months: Hycrete / No Exposure



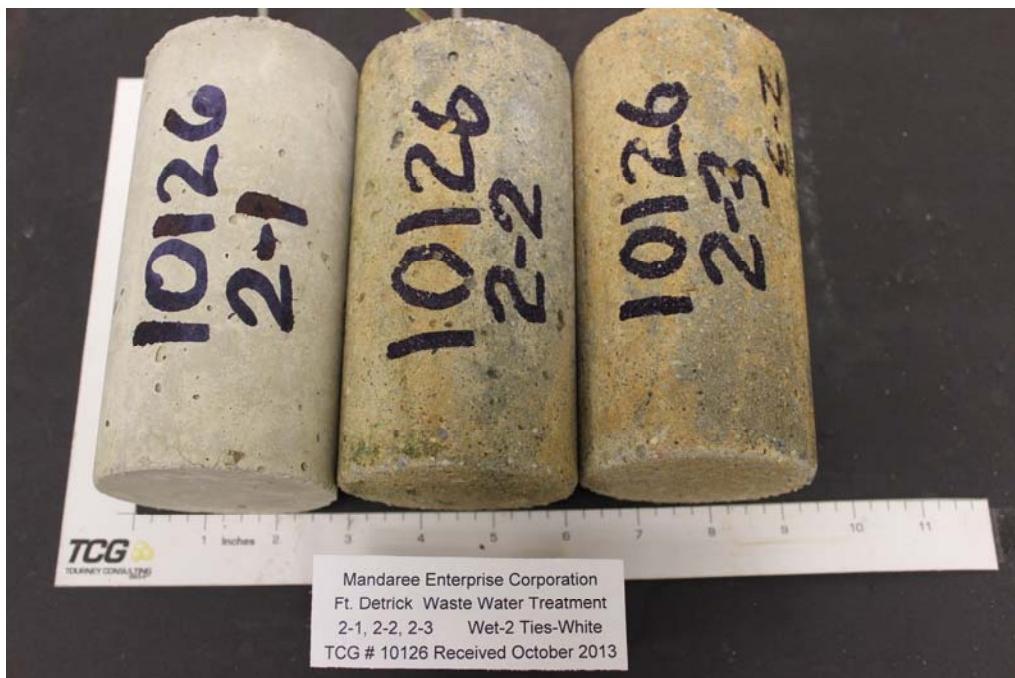
24 Months: Controls / Above Water Line



24 Months: Hycrete / Above Water Line



24 Months: Controls / Partially Submerged



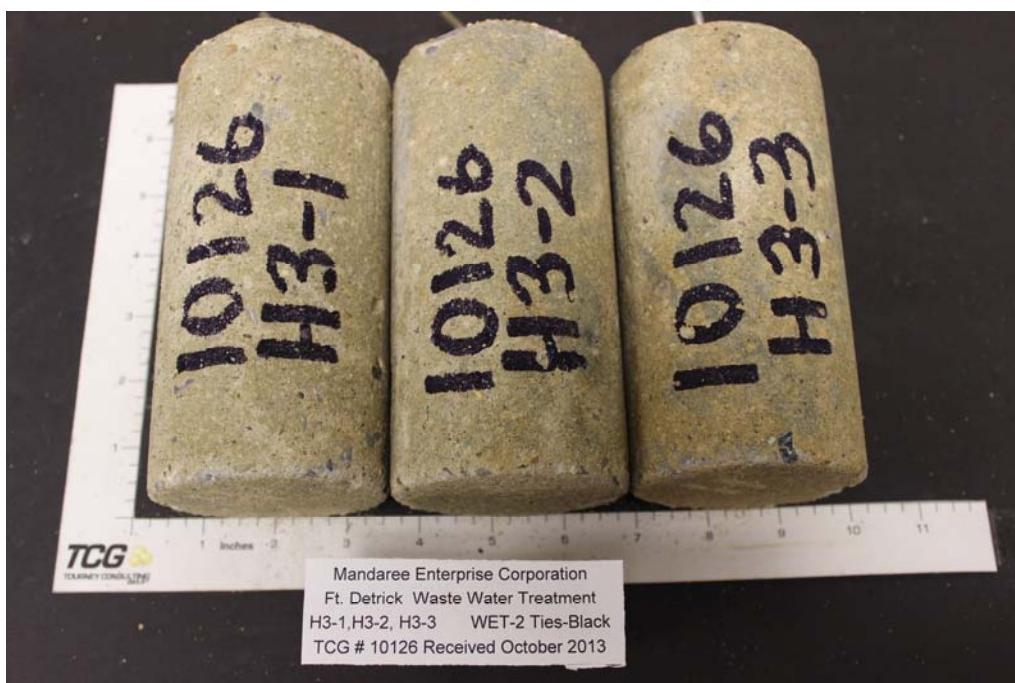
24 Months: Hycrete / Partially Submerged



24 Months: Control / Submerged



24 Months: Hycrete / Submerged



Conclusions:

There does not appear to be any obvious visual differences between the controls and the Hycrete containing concrete. There is some progressive deterioration based on exposure but none would be classified as severe.

Lab Test Results - pH: The side of core samples were milled with a drill-press to obtain pulverized concrete. The milling involved three depth of :1/8", 1/4" and 3/8" from the surface of concrete cylinders. Next, 5 gram samples were diluted with 15 ml of de-ionized water and stirred for 15 minutes. After stirring, the mixtures were filtrated through medium-coarse filter paper and immediately tested for pH with a pH-meter. The testing procedure and sample preparation method followed guidelines published in the Concrete International Journal (April 2007, page 78 - 83).

12-month pH	Control			ID	Hycrete		
	Depth Increment				ID	1/8"	1/4"
Above the Water Line				Above the Water Line			
1-8	12.06	12.16	12.29	H1-8	11.56	12.02	12.16
1-9	12.03	12.18	12.24	H1-9	11.75	12.02	12.19
1-12	12.23	12.26	12.30	No Tag Cyl	11.63	12.07	12.29
Average	12.11	12.20	12.28		11.65	12.04	12.21
Partially Submerged				Partially Submerged			
2-8	11.86	12.25	12.32	H2-8	11.89	12.29	12.31
2-9	12.00	12.28	12.36	H4-9?	11.91	12.29	12.30
2-12	11.81	12.31	12.34	H2-12	11.61	12.20	12.23
Average	11.89	12.28	12.34		11.80	12.26	12.28
Submerged				Submerged			
3-8	11.53	12.21	12.27	H3-8	11.35	12.06	12.20
3-9	11.48	12.29	12.31	H3-9	11.39	12.18	12.22
3-12	11.28	12.23	12.25	H3-12	11.48	12.18	12.23
Average	11.43	12.24	12.28		11.41	12.14	12.22
No Exposure				No Exposure			
4-1	12.22	12.14	12.12	H4-8	11.68	12.04	12.17
4-2	12.11	11.96	12.30	H4-10	11.72	11.85	12.06
4-3	12.25	12.21	12.38	H4-12	11.64	12.00	12.12
Average	12.19	12.10	12.27		11.68	11.96	12.12

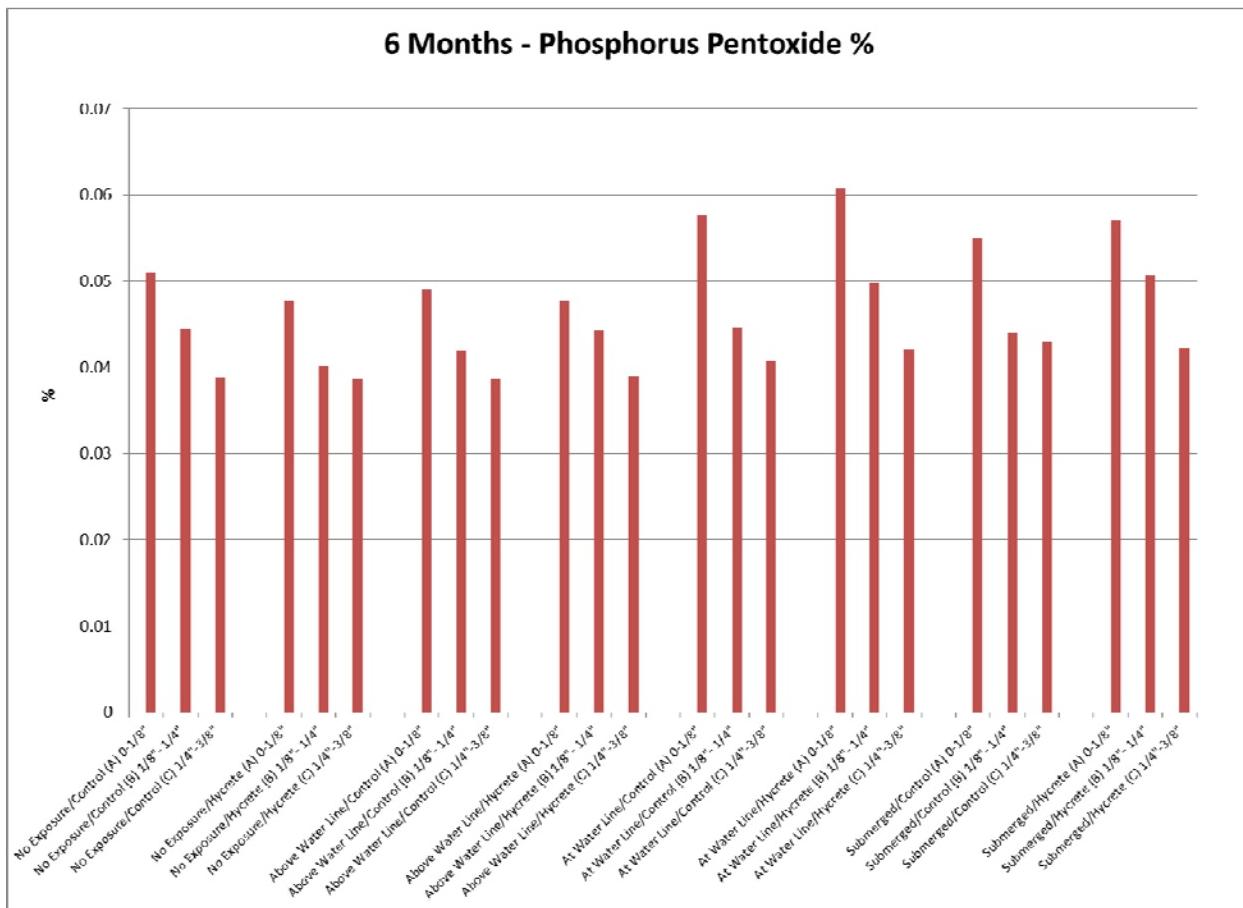
18-month pH	Control			ID	Hycrete		
	Depth Increment				Depth Increment		
ID	1/8"	1/4"	3/8"	ID	1/8"	1/4"	3/8"
Above the Water Line				Above the Water Line			
1-7	10.92	12.40	12.46	H1-7	11.05	11.68	12.15
1-10	12.21	11.93	12.36	H1-10	10.53	11.82	12.29
1-11	12.38	12.32	12.40	H1-11	10.80	11.96	12.34
Average	11.84	12.22	12.41		10.79	11.82	12.26
Partially Submerged				Partially Submerged			
2-7	11.90	12.32	12.39	H2-7	11.78	12.40	12.46
2-10	11.89	12.38	12.37	H4-11	11.78	12.42	12.47
2-11	11.60	12.30	12.37	H2-11	11.39	12.28	12.38
Average	11.80	12.33	12.38		11.65	12.37	12.44
Submerged				Submerged			
3-7	11.35	12.34	12.40	H3-7	10.14	12.04	12.40
3-10	11.66	12.26	12.41	H3-10	11.07	12.30	12.37
3-11	11.23	12.34	12.44	H3-11	11.25	12.40	12.46
Average	11.41	12.31	12.42		10.82	12.25	12.41
No Exposure				No Exposure			
4-7	12.40	12.48	12.48	H4-2	11.22	12.01	12.26
4-10	12.42	12.45	12.48	H4-3	11.07	12.09	12.36
4-11	12.30	12.39	12.47	H4-6	11.10	12.11	12.35
Average	12.37	12.44	12.48		11.13	12.07	12.32

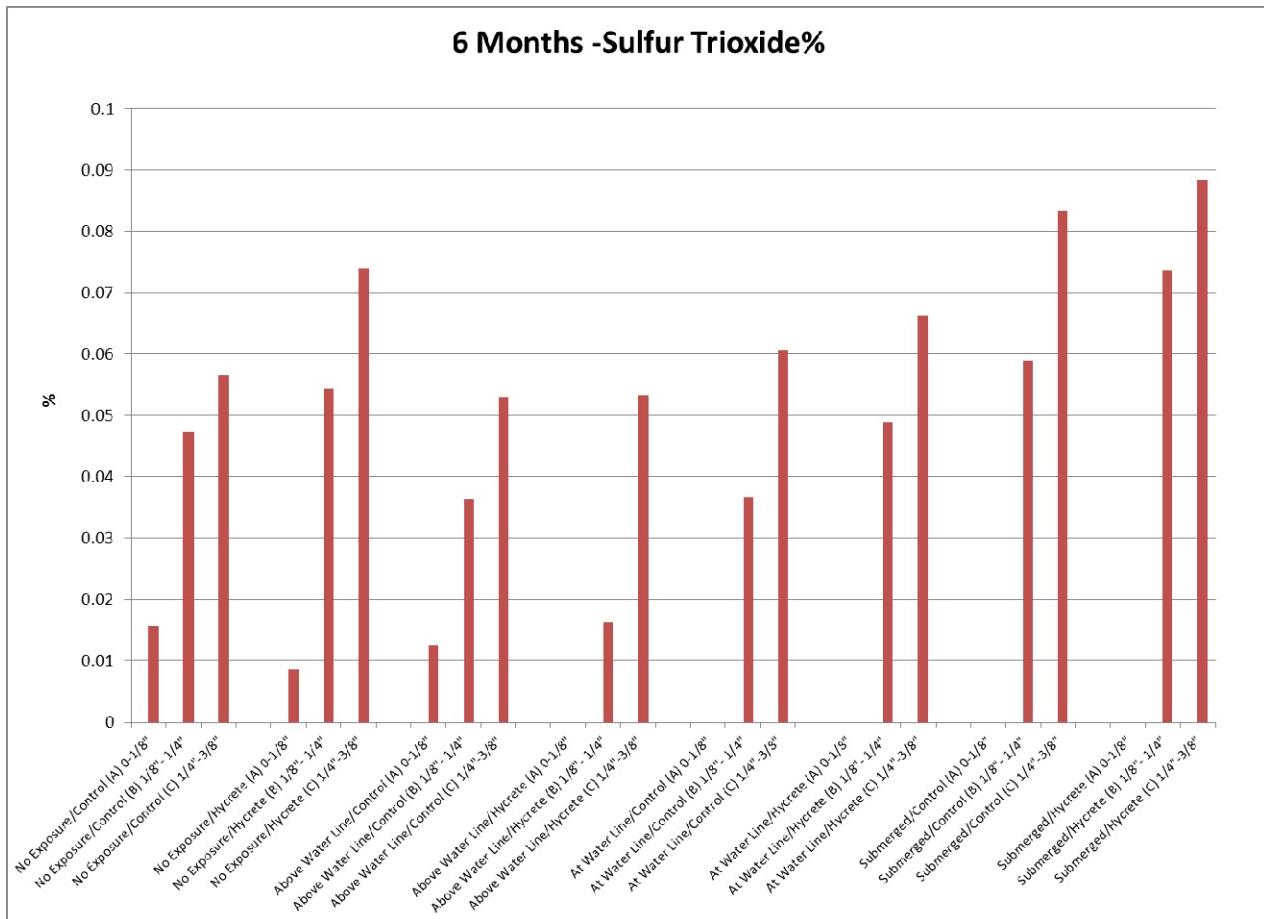
24-month pH		Control			Hycrete			
		Depth Increment				Depth Increment		
ID		1/8"	1/4"	3/8"	ID	1/8"	1/4"	3/8"
Above the Water Line					Above the Water Line			
1-1	12.24	12.36	12.41		H1-1	10.43	11.80	12.17
1-2	12.28	12.37	12.43		H1-2	10.22	11.56	12.19
1-3	12.36	12.39	12.41		H1-3	10.20	11.79	12.32
Average	12.29	12.37	12.42			10.28	11.72	12.23
Partially Submerged					Partially Submerged			
Clean & dry 2-1	12.12	12.36	12.40	Clean & dry H2-1	10.89	11.98	12.26	
2-2	11.93	12.27	12.28	H-2-2	11.90	12.25	12.38	
2-3	11.92	12.21	12.31	H-2-3	11.58	12.24	12.35	
Average	11.99	12.28	12.33			11.46	12.16	12.33
Submerged					Submerged			
3-1	11.51	12.28	12.31	H3-1	10.74	12.09	12.40	
3-2	11.43	12.15	12.29	H3-2	11.20	12.28	12.41	
3-3	11.82	12.33	12.38	H3-3	10.68	12.13	12.24	
Average	11.59	12.25	12.33			10.87	12.17	12.35
No Exposure					No Exposure			
4-5	12.35	12.40	12.44	H4-4	10.66	12.06	12.28	
4-6	12.28	12.42	12.42	H4-5	10.79	11.93	12.33	
4-4	12.30	12.40	12.45	H4-7	10.75	12.01	12.31	
Average	12.31	12.41	12.44			10.73	12.00	12.31

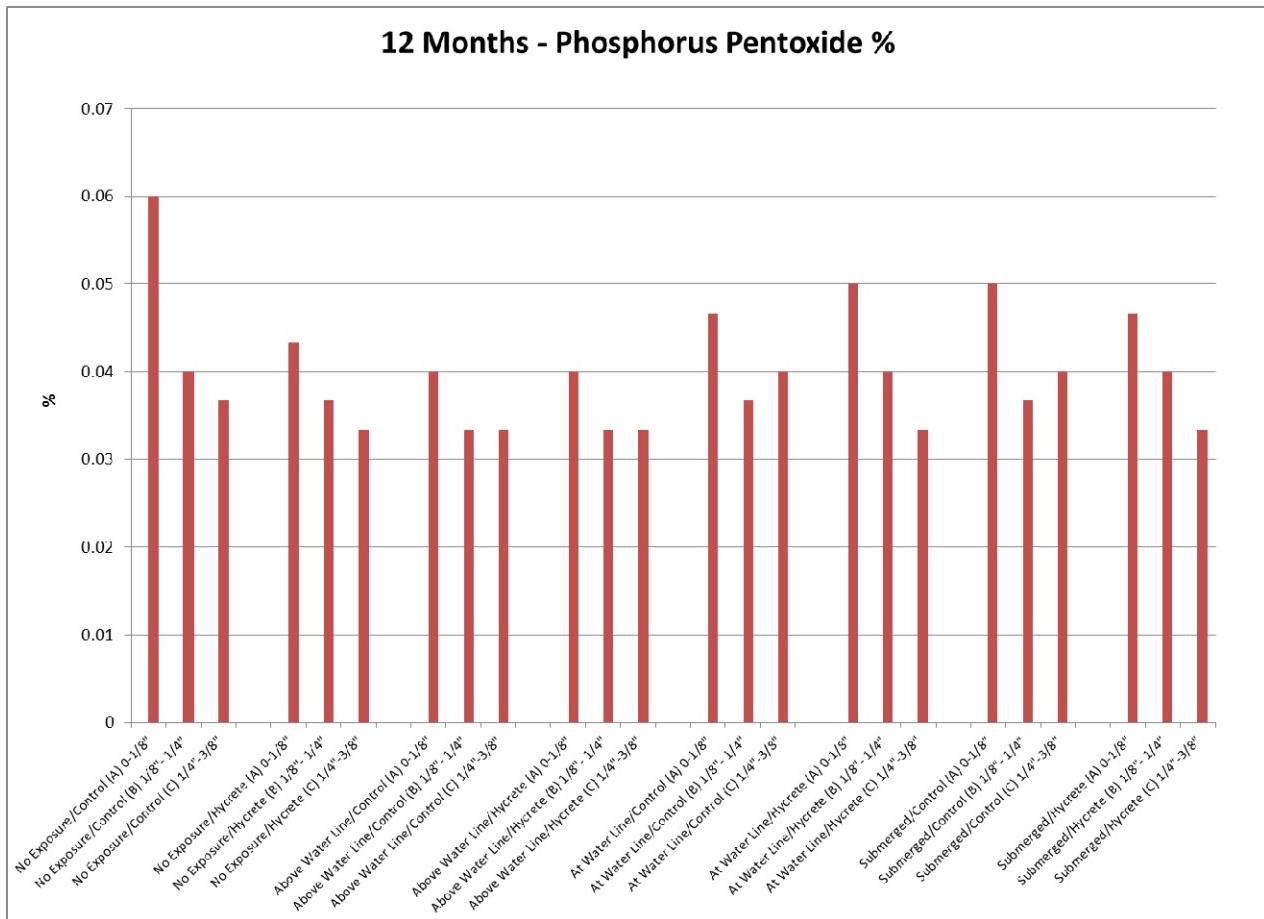
pH Changes	Control			Hycrte		
	Depth Increment			Depth Increment		
	ID	1/8"	1/4"	3/8"	1/8"	1/4"
Above the Water Line						
18 months / 12 months	98%	100%	101%	93%	98%	100%
24 months / 12 months	102%	101%	101%	88%	97%	100%
24 months / 18 months	104%	101%	100%	95%	99%	100%
Partially Submerged						
18 months / 12 months	99%	100%	100%	99%	101%	101%
24 months / 12 months	101%	100%	100%	97%	99%	100%
24 months / 18 months	102%	100%	100%	98%	98%	99%
Submerged						
18 months / 12 months	100%	101%	101%	95%	101%	102%
24 months / 12 months	101%	100%	100%	95%	100%	101%
24 months / 18 months	102%	100%	99%	100%	99%	100%
No Exposure						
18 months / 12 months	101%	103%	102%	95%	101%	102%
24 months / 12 months	101%	103%	101%	92%	100%	102%
24 months / 18 months	99%	100%	100%	96%	99%	100%

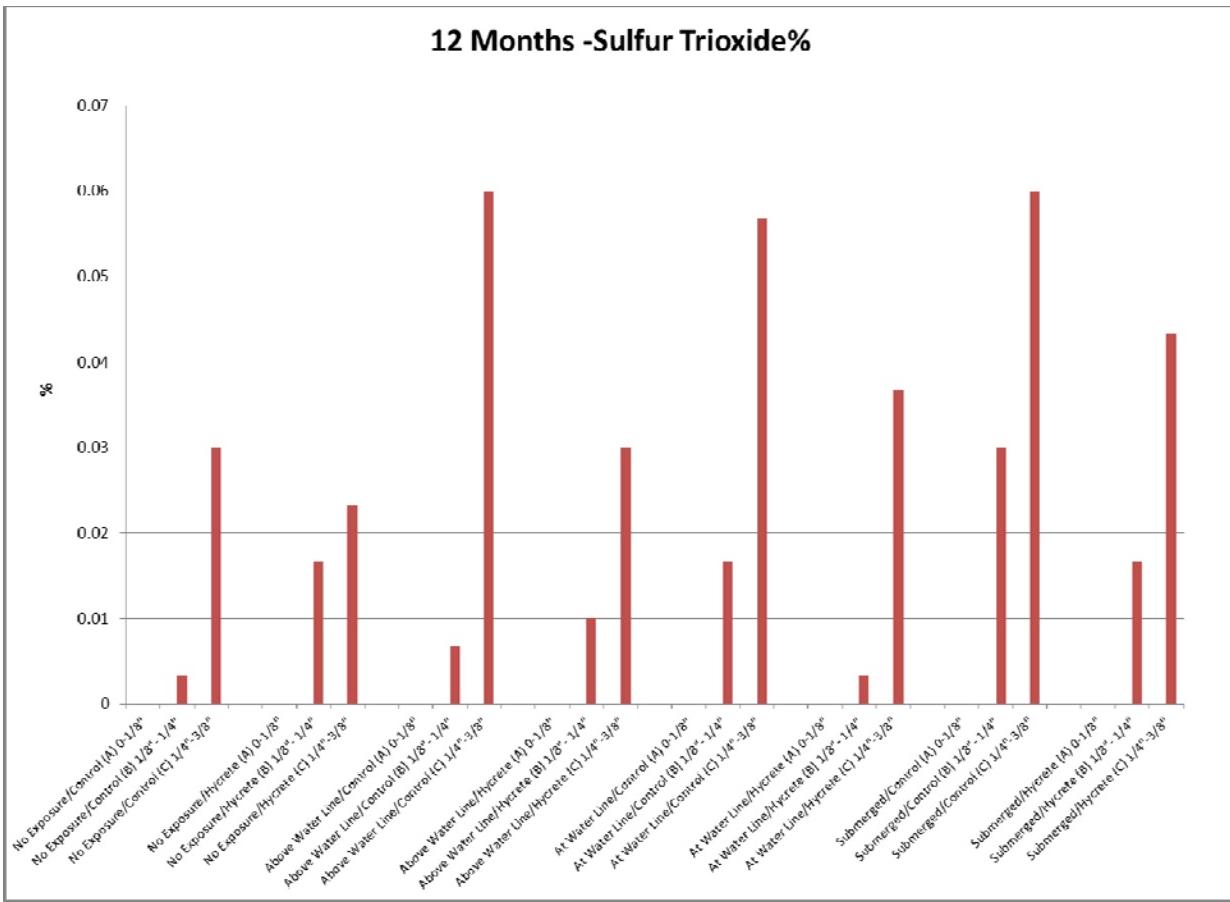
pH Changes	Control / Hycrete			Hycrete / Control		
	Depth Increment			Depth Increment		
	ID	1/8"	1/4"	3/8"	1/8"	1/4"
Above the Water Line						
12 months	104%	101%	101%	96%	99%	99%
18 months	110%	103%	101%	91%	97%	99%
24 month	120%	106%	102%	84%	95%	98%
Partially Submerged						
12 months	101%	100%	100%	99%	100%	100%
18 months	101%	100%	100%	99%	100%	100%
24 month	105%	101%	100%	96%	99%	100%
Submerged						
12 months	100%	101%	100%	100%	99%	100%
18 months	105%	101%	100%	95%	99%	100%
24 month	107%	101%	100%	94%	99%	100%
No Exposure						
12 months	104%	101%	101%	96%	99%	99%
18 months	111%	103%	101%	90%	97%	99%
24 month	115%	103%	101%	87%	97%	99%

Lab Test Results - Chemical Testing: Samples were prepared for analysis by drying each replicate in the oven for 1 hour at 60°C and allowed to cool in the desiccator to room temperature. Weighed out 9 grams of sample to 1.5 grams of dry cellulose, using a ring and puck apparatus ground the sample for 30 seconds. The sample composite was then pressed into a pellet with the aid of a hydraulic press. To aid the pellet strength, the composite was pressed into a thin aluminum container. Each sample was pressed using a press at 25 tons for 1 minute. The subsequent pellet was then analyzed by X-Ray Fluorescence (XRF) using a Bruker Model S4 Explorer in ASTM CI14 mode. analysis was performed using X-Ray Fluorescence (XRF) against the ASTM C 114 calibration mode to determine the oxide composition. Thus, a relative composition of oxides are presented. Graphs of average data are presented below. Full data sets are presented as attachments (for ease of reading).

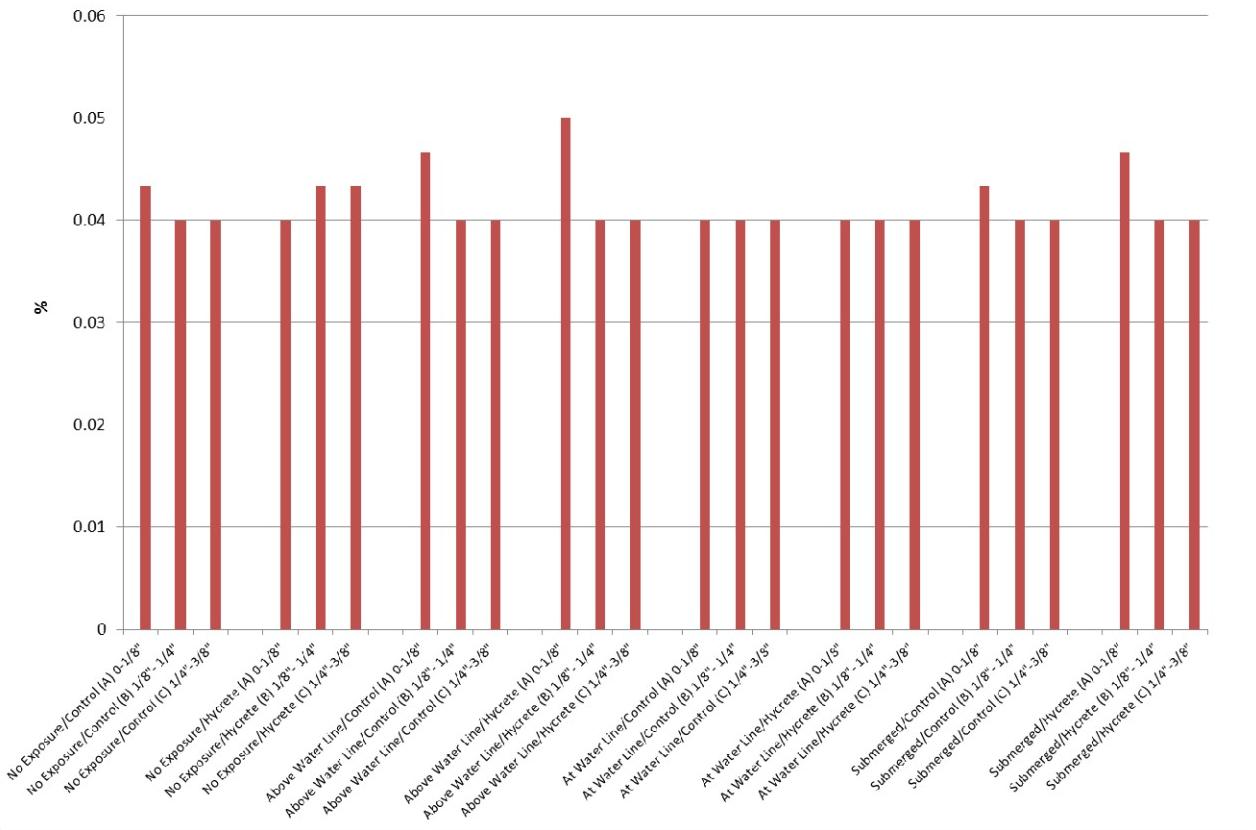


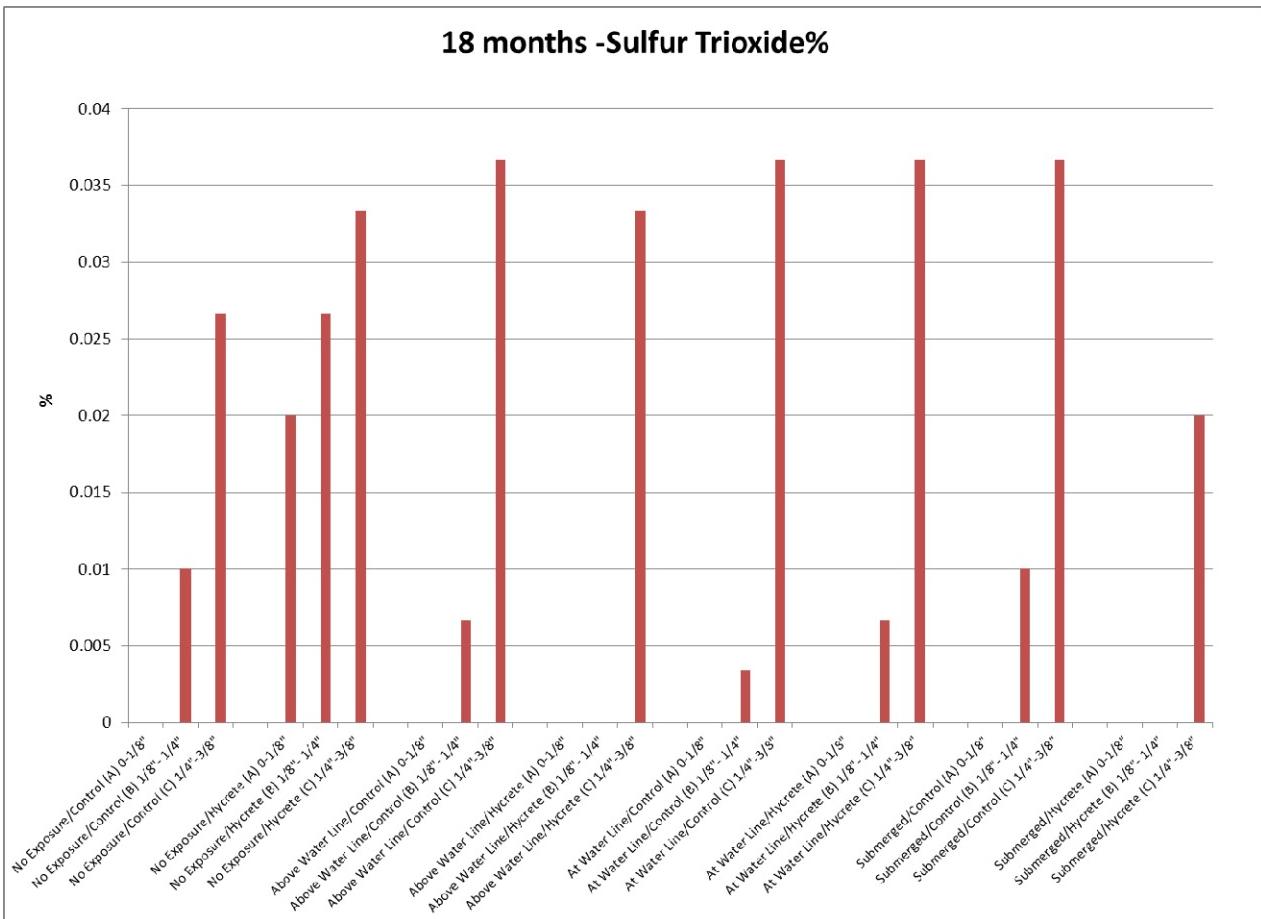


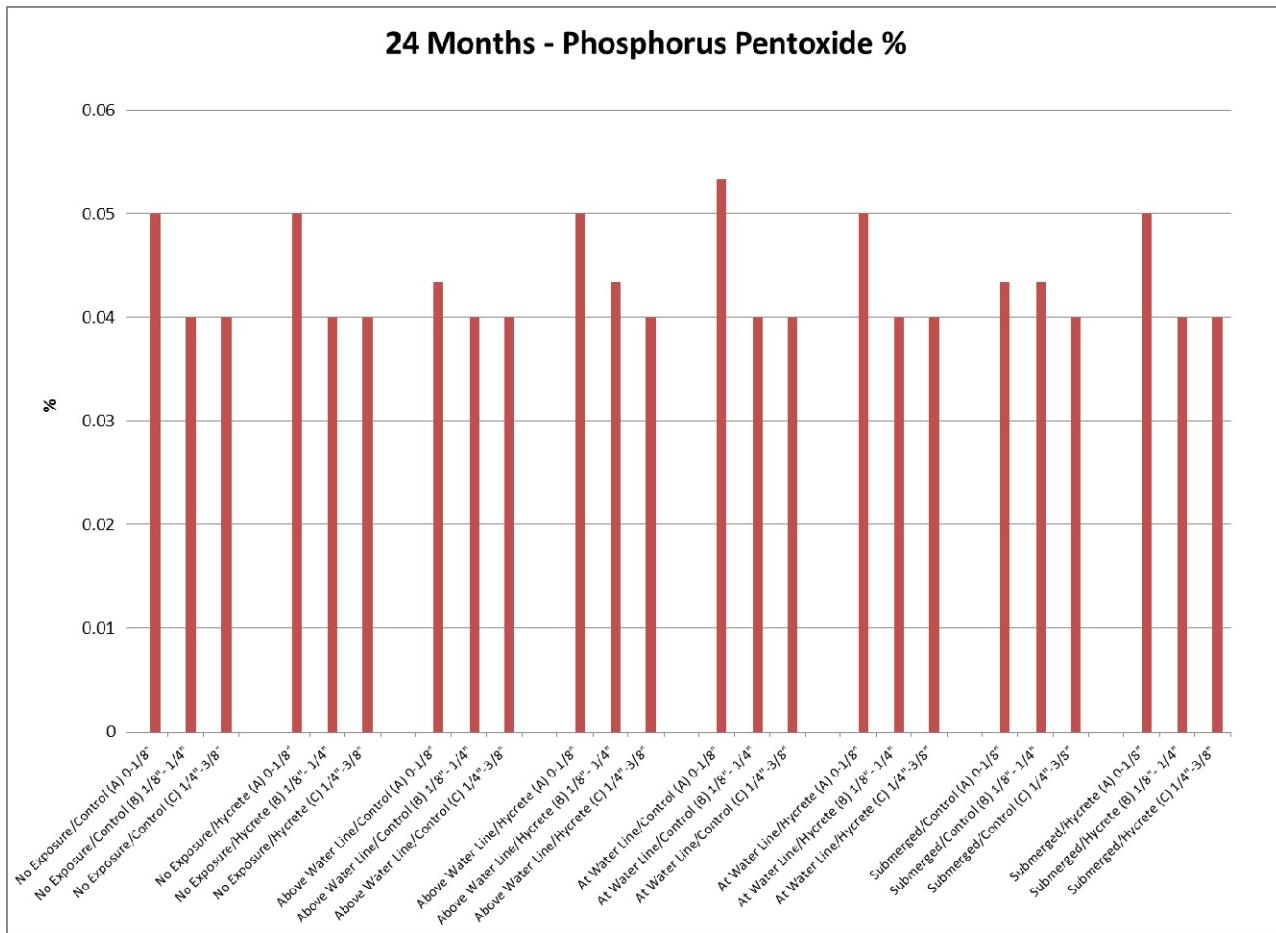


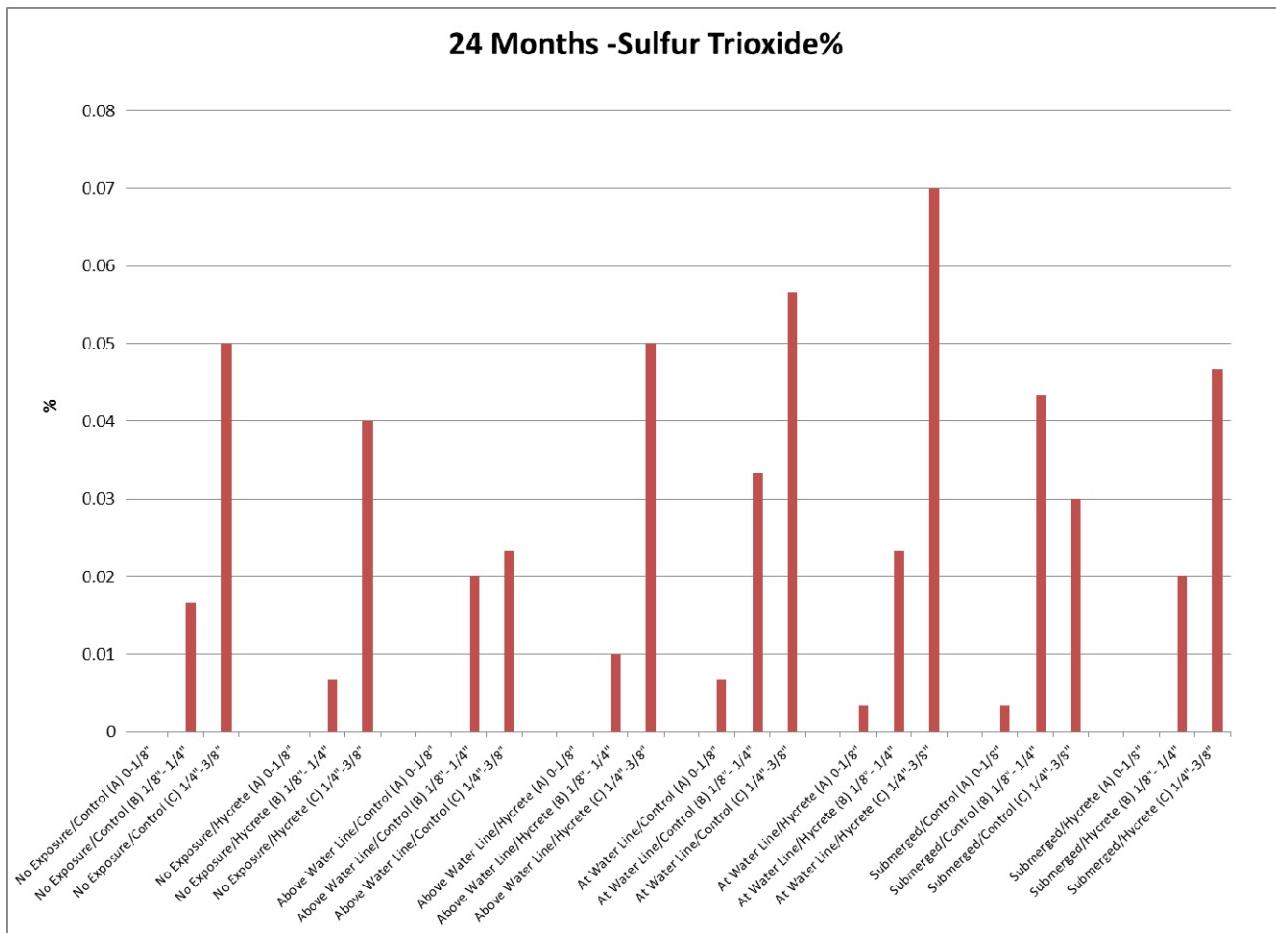


18 months - Phosphorus Pentoxide %









Analysis:

Changes in concentration over time are noted in the appendix. The primary test values associated with the program are summarized below.

	Phosphorus Pentoxide % (P2O5)				Sulfur Trioxide % (SO3)			
<u>Sample (Average of 3)</u>	6 Months	12 Months	18 Months	24 Months	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	0.051	0.060	0.043	0.050	0.016	0.000	0.000	0.000
No Exposure/Control (B) 1/8"- 1/4"	0.044	0.040	0.040	0.040	0.047	0.003	0.010	0.017
No Exposure/Control (C) 1/4"-3/8"	0.039	0.037	0.040	0.040	0.057	0.030	0.027	0.050
No Exposure/Hycrete (A) 0-1/8"	0.048	0.043	0.040	0.050	0.009	0.000	0.020	0.000
No Exposure/Hycrete (B) 1/8"- 1/4"	0.040	0.037	0.043	0.040	0.054	0.017	0.027	0.007
No Exposure/Hycrete (C) 1/4"-3/8"	0.039	0.033	0.043	0.040	0.074	0.023	0.033	0.040
Above Water Line/Control (A) 0-1/8"	0.049	0.040	0.047	0.043	0.013	0.000	0.000	0.000
Above Water Line/Control (B) 1/8"- 1/4"	0.042	0.033	0.040	0.040	0.036	0.007	0.007	0.020
Above Water Line/Control (C) 1/4"-3/8"	0.039	0.033	0.040	0.040	0.053	0.060	0.037	0.023
Above Water Line/Hycrete (A) 0-1/8"	0.048	0.040	0.050	0.050	0.000	0.000	0.000	0.000
Above Water Line/Hycrete (B) 1/8"- 1/4"	0.044	0.033	0.040	0.043	0.016	0.010	0.000	0.010
Above Water Line/Hycrete (C) 1/4"-3/8"	0.039	0.033	0.040	0.040	0.053	0.030	0.033	0.050
At Water Line/Control (A) 0-1/8"	0.058	0.047	0.040	0.053	0.000	0.000	0.000	0.007
At Water Line/Control (B) 1/8"- 1/4"	0.045	0.037	0.040	0.040	0.037	0.017	0.003	0.033
At Water Line/Control (C) 1/4"-3/8"	0.041	0.040	0.040	0.040	0.061	0.057	0.037	0.057
At Water Line/Hycrete (A) 0-1/8"	0.061	0.050	0.040	0.050	0.000	0.000	0.000	0.003
At Water Line/Hycrete (B) 1/8"- 1/4"	0.050	0.040	0.040	0.040	0.049	0.003	0.007	0.023
At Water Line/Hycrete (C) 1/4"-3/8"	0.042	0.033	0.040	0.040	0.066	0.037	0.037	0.070
Submerged/Control (A) 0-1/8"	0.055	0.050	0.043	0.043	0.000	0.000	0.000	0.003
Submerged/Control (B) 1/8"- 1/4"	0.044	0.037	0.040	0.043	0.059	0.030	0.010	0.043
Submerged/Control (C) 1/4"-3/8"	0.043	0.040	0.040	0.040	0.083	0.060	0.037	0.030
Submerged/Hycrete (A) 0-1/8"	0.057	0.047	0.047	0.050	0.000	0.000	0.000	0.000
Submerged/Hycrete (B) 1/8"- 1/4"	0.051	0.040	0.040	0.040	0.074	0.017	0.000	0.020
Submerged/Hycrete (C) 1/4"-3/8"	0.042	0.033	0.040	0.040	0.088	0.043	0.020	0.047

Sincerely,

Glenn Schaefer
Vice President

Appendix

6 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
18 Month I																
Control	(A) 0-1/8"	12044-1.1	2.918	1.28	68.39	24.588	0	2.8	0.142	0.1662	0.063	0.053	0.2484	0.0137	0.0807	
	(A) 0-1/8"	12044-2.1	2.737	1.096	59.359	27.999	0.033	2.758	0.198	0.1539	0.037	0.0494	0.1589	0.011	0.0747	
	(A) 0-1/8"	12044-3.1	2.877	1.148	61.474	27.116	0.014	2.999	0.217	0.1591	0.052	0.0507	0.1747	0.0119	0.0767	
	Average		2.844	1.175	63.074	26.568	0.016	2.852	0.186	0.160	0.051	0.051	0.194	0.012	0.077	
	(B) 1/8" - 1/4"	12044-1.2	2.699	1.095	56.568	29.992	0.024	2.623	0.223	0.150	0.053	0.045	0.173	0.010	0.068	
	(B) 1/8" - 1/4"	12044-2.2	2.598	1.048	49.468	33.152	0.057	2.653	0.280	0.140	0.030	0.045	0.136	0.009	0.067	
	(B) 1/8" - 1/4"	12044-3.2	2.794	1.101	51.804	31.521	0.061	3.168	0.311	0.155	0.040	0.044	0.125	0.009	0.069	
	Average		2.697	1.081	52.613	31.555	0.047	2.815	0.271	0.149	0.041	0.044	0.144	0.009	0.068	
	(C) 1/4" - 3/8"	12044-1.3	2.530	1.025	44.592	35.807	0.048	2.519	0.350	0.142	0.028	0.039	0.123	0.008	0.061	
	(C) 1/4" - 3/8"	12044-2.3	2.550	0.983	42.614	36.701	0.065	2.644	0.386	0.143	0.031	0.041	0.099	0.008	0.061	
	(C) 1/4" - 3/8"	12044-3.3	2.591	1.011	42.766	36.183	0.057	3.132	0.413	0.137	0.039	0.037	0.109	0.007	0.059	
	Average		2.557	1.006	43.324	36.230	0.057	2.765	0.383	0.141	0.033	0.039	0.110	0.008	0.060	
Hycrete	(A) 0-1/8"	12044-4.1	2.758	1.13	60.121	27.27	0	2.648	0.216	0.1562	0.062	0.0488	0.1587	0.0113	0.0761	
	(A) 0-1/8"	12044-5.1	2.761	1.107	56.303	28.894	0.021	2.874	0.239	0.1602	0.063	0.0464	0.1601	0.0107	0.0761	
	(A) 0-1/8"	12044-6.1	2.81	1.139	59.797	27.379	0.005	2.87	0.217	0.1607	0.066	0.048	0.1776	0.0113	0.0778	
	Average		2.776	1.125	58.740	27.848	0.009	2.797	0.224	0.159	0.064	0.048	0.165	0.011	0.077	
	(B) 1/8" - 1/4"	12044-4.2	2.65	1.002	48.342	33.358	0.047	2.681	0.332	0.1433	0.059	0.0412	0.1247	0.0086	0.0649	
	(B) 1/8" - 1/4"	12044-5.2	2.657	0.98	45.166	34.599	0.067	3.192	0.413	0.1424	0.053	0.0393	0.1079	0.0089	0.0628	
	(B) 1/8" - 1/4"	12044-6.2	2.659	0.957	46.284	34.189	0.049	3.036	0.377	0.1428	0.064	0.0401	0.1003	0.0084	0.0637	
	Average		2.655	0.980	46.597	34.049	0.054	2.970	0.374	0.143	0.059	0.040	0.111	0.009	0.064	
	(C) 1/4" - 3/8"	12044-4.3	2.682	0.927	39.093	38.702	0.076	2.827	0.5	0.1456	0.059	0.0392	0.0783	0.0071	0.0599	
	(C) 1/4" - 3/8"	12044-5.3	2.64	0.991	40.381	36.83	0.099	3.261	0.446	0.1408	0.054	0.0387	0.099	0.0078	0.0661	
	(C) 1/4" - 3/8"	12044-6.3	2.661	0.942	44.63	35.285	0.047	2.959	0.415	0.1379	0.068	0.0379	0.0943	0.0078	0.0598	
	Average		2.661	0.953	41.368	36.939	0.074	3.016	0.454	0.141	0.060	0.039	0.091	0.008	0.062	

6 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Above Water Line	Control	(A) 0-1/8"	12044-7.1	2.678	1.088	61.372	27.441	0.011	2.62	0.192	0.1509	0.049	0.0486	0.1571	0.0124	0.0751
		(A) 0-1/8"	12044-8.1	2.803	1.128	66.648	25.064	0	2.75	0.162	0.1655	0.053	0.0491	0.1859	0.0185	0.0769
		(A) 0-1/8"	12044-9.1	2.824	1.099	59.995	27.561	0.027	2.759	0.239	0.1587	0.052	0.0495	0.1585	0.0121	0.076
		Average		2.768	1.105	62.672	26.689	0.013	2.710	0.198	0.158	0.051	0.049	0.167	0.014	0.076
		(B) 1/8" - 1/4"	12044-7.2	2.501	0.997	49.107	33.314	0.04	2.548	0.292	0.1397	0.034	0.0399	0.125	0.0088	0.0637
	Hycrete	(B) 1/8" - 1/4"	12044-8.2	2.677	1.037	54.048	30.225	0.024	2.796	0.28	0.1467	0.044	0.0407	0.133	0.0103	0.0641
		(B) 1/8" - 1/4"	12044-9.2	2.7	0.993	49.088	33.116	0.045	2.554	0.344	0.1475	0.037	0.0449	0.1175	0.009	0.0644
		Average		2.626	1.009	50.748	32.218	0.036	2.633	0.305	0.145	0.038	0.042	0.125	0.009	0.064
		(C) 1/4" - 3/8"	12044-7.3	2.581	0.988	42.646	36.801	0.062	2.778	0.403	0.1379	0.038	0.0378	0.1031	0.008	0.0597
		(C) 1/4" - 3/8"	12044-8.3	2.648	0.978	47.655	33.975	0.049	2.717	0.359	0.1426	0.036	0.0391	0.1043	0.0085	0.0621
		(C) 1/4" - 3/8"	12044-9.3	2.537	0.924	42.298	37.072	0.048	2.488	0.429	0.1402	0.036	0.0389	0.095	0.0073	0.0579
		Average		2.589	0.963	44.200	35.949	0.053	2.661	0.397	0.140	0.037	0.039	0.101	0.008	0.060

		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Below Water Line	Control	(A) 0-1/8"	12044-10.1	2.71	1.068	63.602	26.094	0	2.483	0.205	0.159	0.07	0.0482	0.1669	0.0123	0.0751
		(A) 0-1/8"	12044-11.1	2.834	1.068	53.095	30.281	0.000	2.619	0.332	0.156	0.050	0.048	0.134	0.011	0.072
		(A) 0-1/8"	12044-12.1	2.715	1.132	65.347	25.223	0.000	2.631	0.171	0.153	0.062	0.047	0.201	0.013	0.078
		Average		2.753	1.089	60.681	27.199	0.000	2.578	0.236	0.156	0.061	0.048	0.167	0.012	0.075
		(B) 1/8" - 1/4"	12044-10.2	2.755	1.052	59.938	28.031	0.004	2.513	0.212	0.143	0.057	0.046	0.149	0.011	0.069
	Hycrete	(B) 1/8" - 1/4"	12044-11.2	2.715	1.038	50.824	31.464	0.039	2.890	0.322	0.143	0.040	0.045	0.134	0.009	0.067
		(B) 1/8" - 1/4"	12044-12.2	2.695	1.053	56.013	29.145	0.006	2.694	0.249	0.145	0.057	0.043	0.166	0.010	0.068
		Average		2.722	1.048	55.592	29.547	0.016	2.699	0.261	0.144	0.051	0.044	0.150	0.010	0.068
		(C) 1/4" - 3/8"	12044-10.3	2.650	1.023	49.260	33.056	0.045	2.538	0.317	0.141	0.050	0.039	0.127	0.009	0.065
		(C) 1/4" - 3/8"	12044-11.3	2.671	1.005	43.761	35.489	0.068	2.981	0.394	0.144	0.045	0.040	0.103	0.008	0.063
		(C) 1/4" - 3/8"	12044-12.3	2.589	1.001	45.888	34.776	0.047	2.700	0.359	0.141	0.050	0.039	0.127	0.008	0.064
		Average		2.637	1.010	46.303	34.440	0.053	2.740	0.357	0.142	0.048	0.039	0.119	0.008	0.064

6 Month Data														
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		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
At Water Line	Control	(A) 0-1/8"	12044-13.1	2.832	1.091	62.833	21.17	0	2.658	0.083	0.1463	0.025	0.0598	0.2068	0.0149	0.0673
		(A) 0-1/8"	12044-14.1	2.91	1.259	66.101	25.056	0	2.93	0.121	0.1583	0.027	0.0573	0.2074	0.0148	0.0715
		(A) 0-1/8"	12044-15.1	2.887	1.261	69.098	23.788	0	2.768	0.078	0.1548	0.022	0.0559	0.2191	0.0142	0.0734
		Average		2.88	1.20	66.01	23.34	0.00	2.79	0.09	0.15	0.02	0.06	0.21	0.01	0.07
		(B) 1/8" - 1/4"	12044-13.2	2.651	1.09	56.377	29.46	0.019	2.688	0.166	0.148	0.025	0.0473	0.1629	0.0099	0.0662
	Hycrete	(B) 1/8" - 1/4"	12044-14.2	2.754	1.072	51.281	31.823	0.038	2.934	0.283	0.1491	0.034	0.0459	0.1314	0.0099	0.0641
		(B) 1/8" - 1/4"	12044-15.2	2.509	1.095	52.686	31.34	0.053	2.7	0.21	0.14	0.02	0.0405	0.1414	0.0094	0.0625
		Average		2.64	1.09	53.45	30.87	0.04	2.77	0.22	0.15	0.03	0.04	0.15	0.01	0.06
		(C) 1/4" - 3/8"	12044-13.3	2.57	1.042	42.529	36.507	0.063	2.753	0.352	0.1394	0.02	0.0396	0.1149	0.0077	0.0595
		(C) 1/4" - 3/8"	12044-14.3	2.761	1.005	43.275	36.416	0.073	2.61	0.428	0.1472	0.037	0.0418	0.092	0.0082	0.0606
		(C) 1/4" - 3/8"	12044-15.3	2.564	1.177	48.75	33.197	0.046	2.775	0.298	0.1409	0.023	0.0407	0.2267	0.0085	0.0668
		Average		2.63	1.07	44.85	35.37	0.06	2.71	0.36	0.14	0.03	0.04	0.14	0.01	0.06

6 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Submerged	Control	(A) 0-1/8"	12044-19.1	2.932	1.292	69.263	22.946	0	2.784	0.094	0.1508	0.022	0.0535	0.2371	0.0149	0.0779
		(A) 0-1/8"	12044-20.1	3.052	1.334	70.702	22.68	0	2.794	0.116	0.1525	0.028	0.0551	0.2583	0.0154	0.0783
		(A) 0-1/8"	12044-21.1	3.121	1.447	70.615	21.889	0	3.305	0.088	0.1589	0.028	0.0561	0.264	0.0181	0.0822
		Average		3.035	1.358	70.193	22.505	0.000	2.961	0.099	0.154	0.026	0.055	0.253	0.016	0.079
		(B) 1/8" - 1/4"	12044-19.2	2.63	1.069	48.906	32.909	0.077	2.559	0.268	0.1471	0.026	0.0455	0.1304	0.0093	0.0671
		(B) 1/8" - 1/4"	12044-20.2	2.681	1.065	50.492	32.049	0.051	2.246	0.298	0.1405	0.022	0.0415	0.1445	0.0096	0.0643
		(B) 1/8" - 1/4"	12044-21.2	2.691	1.094	55.278	29.625	0.049	3.031	0.198	0.1449	0.025	0.0449	0.1571	0.0105	0.0684
		Average		2.667	1.076	51.559	31.528	0.059	2.612	0.255	0.144	0.024	0.044	0.144	0.010	0.067
		(C) 1/4" - 3/8"	12044-19.3	2.62	1.009	42.515	36.253	0.093	2.903	0.392	0.1457	0.04	0.0421	0.0954	0.0079	0.0619
		(C) 1/4" - 3/8"	12044-20.3	2.753	1.039	46.376	34.448	0.079	2.31	0.352	0.1522	0.025	0.0427	0.1126	0.0088	0.0654
		(C) 1/4" - 3/8"	12044-21.3	2.608	1.038	48.066	33.277	0.078	3.14	0.263	0.1455	0.029	0.044	0.1242	0.009	0.065
		Average		2.660	1.029	45.652	34.659	0.083	2.784	0.336	0.148	0.031	0.043	0.111	0.009	0.064
Hycrete	Hycrete	(A) 0-1/8"	12044-22.1	3.126	1.486	70.479	22.307	0	3.213	0.111	0.1597	0.031	0.0596	0.2587	0.0165	0.0784
		(A) 0-1/8"	12044-23.1	3.115	1.328	65.144	24.361	0	3.122	0.142	0.164	0.045	0.0538	0.1914	0.0172	0.0791
		(A) 0-1/8"	12044-24.1	3.217	1.409	66.401	23.939	0	3.069	0.163	0.1654	0.032	0.0575	0.2008	0.0171	0.0798
		Average		3.153	1.408	67.341	23.536	0.000	3.135	0.139	0.163	0.036	0.057	0.217	0.017	0.079
		(B) 1/8" - 1/4"	12044-22.2	2.782	1.164	53.298	29.988	0.067	3.369	0.249	0.1436	0.033	0.0557	0.1414	0.0105	0.0676
		(B) 1/8" - 1/4"	12044-23.2	2.776	1.089	48.764	32.505	0.071	3.002	0.304	0.1425	0.037	0.0473	0.1322	0.0097	0.0634
		(B) 1/8" - 1/4"	12044-24.2	2.773	1.129	47.671	33.327	0.083	2.793	0.333	0.1452	0.036	0.049	0.122	0.01	0.0654
		Average		2.777	1.127	49.911	31.940	0.074	3.055	0.295	0.144	0.035	0.051	0.132	0.010	0.065
		(C) 1/4" - 3/8"	12044-22.3	2.728	1.091	45.694	34.632	0.084	3.014	0.341	0.1434	0.035	0.0462	0.1136	0.0088	0.0647
		(C) 1/4" - 3/8"	12044-23.3	2.682	1.017	42.77	36.112	0.089	2.939	0.348	0.1406	0.037	0.04	0.1017	0.0087	0.0628
		(C) 1/4" - 3/8"	12044-24.3	2.69	1.096	45.039	34.908	0.092	2.898	0.337	0.1435	0.039	0.0407	0.1114	0.0093	0.0634
		Average		2.700	1.068	44.501	35.217	0.088	2.950	0.342	0.143	0.037	0.042	0.109	0.009	0.064

12 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
18 Month I																
Control	(A) 0-1/8"	12044-25-1	2.84	1.14	65.12	27.00	0.00	2.73	0.20	0.16	0.09	0.10	0.17	0.01	0.07	
	(A) 0-1/8"	12044-26-1	2.73	1.13	64.89	27.50	0.00	2.69	0.20	0.16	0.04	0.04	0.16	0.01	0.07	
	(A) 0-1/8"	12044-27-1	2.73	1.17	60.43	28.29	0.00	2.98	0.32	0.15	0.05	0.04	0.18	0.01	0.07	
	Average		2.767	1.147	63.480	27.597	0.000	2.800	0.240	0.157	0.060	0.060	0.170	0.010	0.070	
	(B) 1/8" - 1/4"	12044-25-2	2.63	1.01	48.04	35.26	0.01	2.75	0.41	0.15	0.05	0.04	0.10	0.01	0.06	
	(B) 1/8" - 1/4"	12044-26-2	2.51	1.03	53.51	33.18	0.00	2.87	0.28	0.15	0.05	0.04	0.12	0.01	0.06	
	(B) 1/8" - 1/4"	12044-27-2	2.65	1.08	52.84	32.22	0.00	3.21	0.38	0.15	0.05	0.04	0.13	0.01	0.06	
	Average		2.597	1.040	51.463	33.553	0.003	2.943	0.357	0.150	0.050	0.040	0.117	0.010	0.060	
	(C) 1/4" - 3/8"	12044-25-3	2.62	0.95	46.28	36.30	0.00	2.47	0.43	0.14	0.03	0.03	0.10	0.01	0.06	
	(C) 1/4" - 3/8"	12044-26-3	2.57	1.04	44.85	36.28	0.05	3.15	0.39	0.14	0.05	0.04	0.12	0.01	0.06	
	(C) 1/4" - 3/8"	12044-27-3	2.62	1.07	45.83	35.64	0.04	3.10	0.49	0.15	0.04	0.04	0.11	0.01	0.06	
	Average		2.603	1.020	45.653	36.073	0.030	2.907	0.437	0.143	0.040	0.037	0.110	0.010	0.060	
Hycrete	(A) 0-1/8"	12044-28-1	2.71	1.08	52.95	32.14	0.00	2.63	0.34	0.16	0.04	0.04	0.11	0.02	0.07	
	(A) 0-1/8"	12044-29-1	2.73	1.14	60.51	28.34	0.00	2.74	0.24	0.16	0.05	0.04	0.15	0.01	0.08	
	(A) 0-1/8"	12044-30-1	2.80	1.25	67.28	25.34	0.00	2.74	0.18	0.16	0.05	0.05	0.20	0.02	0.08	
	Average		2.747	1.157	60.247	28.607	0.000	2.703	0.253	0.160	0.047	0.043	0.153	0.017	0.077	
	(B) 1/8" - 1/4"	12044-28-2	2.53	0.98	44.66	37.17	0.02	2.41	0.46	0.15	0.03	0.03	0.09	0.02	0.06	
	(B) 1/8" - 1/4"	12044-29-2	2.59	1.03	42.82	37.90	0.03	2.76	0.49	0.15	0.04	0.04	0.09	0.01	0.06	
	(B) 1/8" - 1/4"	12044-30-2	2.79	1.08	56.90	30.44	0.00	2.95	0.35	0.15	0.05	0.04	0.14	0.02	0.07	
	Average		2.637	1.030	48.127	35.170	0.017	2.707	0.433	0.150	0.040	0.037	0.107	0.017	0.063	
	(C) 1/4" - 3/8"	12044-29-3	2.43	1.00	41.62	38.72	0.04	2.49	0.44	0.14	0.03	0.03	0.10	0.01	0.06	
	(C) 1/4" - 3/8"	12044-28-3	2.53	0.98	42.95	37.85	0.03	2.77	0.46	0.14	0.04	0.03	0.08	0.01	0.06	
	(C) 1/4" - 3/8"	12044-30-3	2.75	1.03	51.00	33.39	0.00	2.81	0.43	0.15	0.04	0.04	0.13	0.01	0.06	
	Average		2.570	1.003	45.190	36.653	0.023	2.690	0.443	0.143	0.037	0.033	0.103	0.010	0.060	

12 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Above Water Line	Control	(A) 0-1/8"	12044-31-1	2.65	1.15	62.61	28.02	0	2.67	0.24	0.16	0.04	0.16	0.01	0.07	
		(A) 0-1/8"	12044-32-1	2.7	1.32	70.11	25.52	0	2.72	0.18	0.16	0.17	0.04	0.25	0.01	0.08
		(A) 0-1/8"	12044-33-1	2.63	1.16	64.48	27.46	0	2.73	0.17	0.16	0.03	0.04	0.16	0.01	0.07
		Average		2.660	1.210	65.733	27.000	0.000	2.707	0.197	0.160	0.080	0.040	0.190	0.010	0.073
		(B) 1/8" - 1/4"	12044-31-2	2.5	1.05	50.62	34.31	0.01	2.71	0.34	0.15	0.03	0.12	0.01	0.06	
		(B) 1/8" - 1/4"	12044-32-2	2.52	1.13	55.41	31.58	0	2.56	0.26	0.15	0.03	0.04	0.16	0.01	0.07
		(B) 1/8" - 1/4"	12044-33-2	2.48	1.06	47.11	35.53	0.01	2.72	0.33	0.14	0.04	0.03	0.12	0.01	0.06
		Average		2.500	1.080	51.047	33.807	0.007	2.663	0.310	0.147	0.033	0.033	0.133	0.010	0.063
		(C) 1/4" - 3/8"	12044-31-3	2.32	1.02	39.1	38.67	0.06	4.16	0.42	0.13	0.03	0.03	0.09	0.01	0.06
		(C) 1/4" - 3/8"	12044-32-3	2.49	1.13	44.58	36.47	0.07	2.39	0.38	0.15	0.03	0.04	0.14	0.01	0.06
		(C) 1/4" - 3/8"	12044-33-3	2.38	0.94	34.63	43.21	0.05	2.78	0.48	0.13	0.06	0.03	0.07	0.01	0.05
		Average		2.397	1.030	39.437	39.450	0.060	3.110	0.427	0.137	0.040	0.033	0.100	0.010	0.057
Hycrete	Hycrete	(A) 0-1/8"	12044-34-1	2.76	1.12	61.66	28.98	0	2.77	0.23	0.16	0.06	0.04	0.15	0.01	0.07
		(A) 0-1/8"	12044-35-1	2.63	1.07	64.55	27.72	0	2.6	0.2	0.15	0.06	0.04	0.16	0.01	0.07
		(A) 0-1/8"	12044-36-1	2.88	1.08	66.2	27.26	0	2.64	0.27	0.16	0.06	0.04	0.15	0.01	0.07
		Average		2.757	1.090	64.137	27.987	0.000	2.670	0.233	0.157	0.060	0.040	0.153	0.010	0.070
		(B) 1/8" - 1/4"	12044-34-2	2.59	0.99	45.75	37.41	0.02	2.62	0.4	0.15	0.06	0.03	0.09	0.01	0.06
		(B) 1/8" - 1/4"	12044-35-2	2.5	0.96	46.33	37.56	0.01	2.38	0.4	0.14	0.03	0.03	0.11	0.01	0.06
		(B) 1/8" - 1/4"	12044-36-2	2.77	1.06	56.51	31.22	0	2.54	0.36	0.15	0.04	0.04	0.15	0.01	0.06
		Average		2.620	1.003	49.530	35.397	0.010	2.513	0.387	0.147	0.043	0.033	0.117	0.010	0.060
		(C) 1/4" - 3/8"	12044-34-3	2.41	0.9	40.29	39.81	0.01	2.52	0.46	0.13	0.06	0.03	0.08	0.01	0.05
		(C) 1/4" - 3/8"	12044-35-3	2.32	0.87	40.17	40.43	0.02	2.29	0.42	0.13	0.03	0.03	0.08	0.01	0.05
		(C) 1/4" - 3/8"	12044-36-3	2.73	1.05	48.34	34.25	0.06	2.68	0.39	0.16	0.04	0.04	0.14	0.01	0.06
		Average		2.487	0.940	42.933	38.163	0.030	2.497	0.423	0.140	0.043	0.033	0.100	0.010	0.053

12 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
At Water Line	Control	(A) 0-1/8"	12044-37-1	2.72	1.2	67.48	26.7	0	2.56	0.13	0.16	0.02	0.05	0.18	0.01	0.07
		(A) 0-1/8"	12044-38-1	2.85	1.15	63.46	27.88	0	2.75	0.22	0.16	0.02	0.04	0.16	0.01	0.07
		(A) 0-1/8"	12044-39-1	2.86	1.21	69.55	25.27	0	2.65	0.13	0.16	0.02	0.05	0.18	0.01	0.07
		Average		2.810	1.187	66.830	26.617	0.000	2.653	0.160	0.160	0.020	0.047	0.173	0.010	0.070
		(B) 1/8" - 1/4"	12044-37-2	2.28	0.91	43.34	39.03	0.03	2.22	0.32	0.13	0.01	0.03	0.09	0.01	0.05
		(B) 1/8" - 1/4"	12044-38-2	2.51	0.02	7.37	34.46	0	0.04	0.4	0.03	0	0.04	0	0	0
		(B) 1/8" - 1/4"	12044-39-2	2.68	1.08	51.89	33.16	0.02	2.77	0.31	0.15	0.02	0.04	0.14	0.01	0.06
		Average		2.490	0.670	34.200	35.550	0.017	1.677	0.343	0.103	0.010	0.037	0.077	0.007	0.037
		(C) 1/4" - 3/8"	12044-37-3	2.45	0.94	42.27	38.5	0.07	2.4	0.34	0.14	0.02	0.04	0.09	0.01	0.06
		(C) 1/4" - 3/8"	12044-38-3	2.47	0.99	44.4	37.26	0.07	2.78	0.34	0.14	0.02	0.04	0.11	0.01	0.06
		(C) 1/4" - 3/8"	12044-39-3	2.75	1.07	49.23	34.2	0.03	3.12	0.38	0.15	0.03	0.04	0.13	0.01	0.06
		Average		2.557	1.000	45.300	36.653	0.057	2.767	0.353	0.143	0.023	0.040	0.110	0.010	0.060
At Water Line	Hycrete	(A) 0-1/8"	12044-40-1	2.98	1.24	72.21	24.45	0	2.93	0.13	0.17	0.03	0.05	0.19	0.01	0.07
		(A) 0-1/8"	12044-41-1	2.79	1.19	65.58	27.25	0	2.88	0.17	0.17	0.04	0.05	0.16	0.01	0.07
		(A) 0-1/8"	12044-42-1	2.8	1.23	62.1	28.3	0	2.76	0.19	0.16	0.04	0.05	0.18	0.02	0.07
		Average		2.857	1.220	66.630	26.667	0.000	2.857	0.163	0.167	0.037	0.050	0.177	0.013	0.070
		(B) 1/8" - 1/4"	12044-40-2	2.79	1.03	53.76	33.11	0	2.97	0.35	0.15	0.04	0.04	0.1	0.01	0.06
		(B) 1/8" - 1/4"	12044-41-2	2.66	1.11	50.04	34.45	0	2.83	0.36	0.15	0.05	0.04	0.12	0.01	0.06
		(B) 1/8" - 1/4"	12044-42-2	2.72	1.01	50.58	34.26	0.01	3.09	0.37	0.15	0.05	0.04	0.1	0.01	0.06
		Average		2.723	1.050	51.460	33.940	0.003	2.963	0.360	0.150	0.047	0.040	0.107	0.010	0.060
		(C) 1/4" - 3/8"	12044-40-3	2.73	1	43.67	38.1	0.01	2.8	0.48	0.15	0.04	0.03	0.08	0.01	0.06
		(C) 1/4" - 3/8"	12044-41-3	2.63	0.97	46.29	37.12	0.03	2.69	0.42	0.14	0.05	0.03	0.08	0.01	0.06
		(C) 1/4" - 3/8"	12044-42-3	2.77	1.01	42.7	37.22	0.07	3.43	0.46	0.15	0.06	0.04	0.1	0.01	0.06
		Average		2.710	0.993	44.220	37.480	0.037	2.973	0.453	0.147	0.050	0.033	0.087	0.010	0.060

12 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Submerged	Control	(A) 0-1/8"	12044-43-1	2.84	1.19	71.52	24.70	0.00	2.96	0.14	0.16	0.03	0.05	0.17	0.01	0.07
		(A) 0-1/8"	12044-44-1	2.84	1.36	68.24	25.01	0.00	2.86	0.13	0.17	0.03	0.05	0.25	0.01	0.08
		(A) 0-1/8"	12044-45-1	2.85	1.26	72.09	23.88	0.00	3.20	0.11	0.16	0.02	0.05	0.19	0.02	0.08
		Average		2.843	1.270	70.617	24.530	0.000	3.007	0.127	0.163	0.027	0.050	0.203	0.013	0.077
		(B) 1/8" - 1/4"	12044-43-2	2.54	1.05	54.06	33.07	0.00	2.66	0.26	0.15	0.02	0.04	0.13	0.01	0.06
		(B) 1/8" - 1/4"	12044-44-2	2.30	1.01	44.94	36.96	0.05	2.53	0.26	0.13	0.02	0.03	0.13	0.01	0.06
		(B) 1/8" - 1/4"	12044-45-2	2.50	1.00	47.61	36.04	0.04	2.98	0.32	0.14	0.02	0.04	0.10	0.01	0.06
		Average		2.447	1.020	48.870	35.357	0.030	2.723	0.280	0.140	0.020	0.037	0.120	0.010	0.060
	Hycrete	(C) 1/4" - 3/8"	12044-43-3	2.56	1.25	49.11	35.15	0.02	2.57	0.32	0.25	0.03	0.04	0.14	0.01	0.06
		(C) 1/4" - 3/8"	12044-44-3	2.68	1.11	48.94	34.20	0.10	2.82	0.33	0.14	0.02	0.04	0.14	0.01	0.06
		(C) 1/4" - 3/8"	12044-45-3	2.50	1.36	38.70	38.75	0.06	3.65	0.45	0.14	0.04	0.04	0.27	0.01	0.07
		Average		2.580	1.240	45.583	36.033	0.060	3.013	0.367	0.177	0.030	0.040	0.183	0.010	0.063
		(A) 0-1/8"	12044-46-1	2.94	1.27	73.28	23.85	0.00	2.98	0.13	0.16	0.03	0.05	0.21	0.02	0.07
		(A) 0-1/8"	12044-47-1	2.86	1.13	64.51	27.06	0.00	3.22	0.23	0.15	0.04	0.04	0.15	0.01	0.07
		(A) 0-1/8"	12044-48-1	2.84	1.28	72.30	23.90	0.00	3.15	0.12	0.15	0.04	0.05	0.20	0.02	0.07
		Average		2.880	1.227	70.030	24.937	0.000	3.117	0.160	0.153	0.037	0.047	0.187	0.017	0.070
	Hycrete	(B) 1/8" - 1/4"	12044-46-2	2.69	1.03	53.24	32.72	0.01	2.89	0.31	0.15	0.04	0.04	0.12	0.01	0.06
		(B) 1/8" - 1/4"	12044-47-2	2.77	1.05	48.88	33.97	0.03	3.42	0.43	0.14	0.04	0.04	0.13	0.01	0.06
		(B) 1/8" - 1/4"	12044-48-2	2.73	1.08	49.47	33.95	0.01	3.48	0.33	0.15	0.04	0.04	0.12	0.01	0.06
		Average		2.730	1.053	50.530	33.547	0.017	3.263	0.357	0.147	0.040	0.040	0.123	0.010	0.060
		(C) 1/4" - 3/8"	12044-46-3	2.64	0.97	46.3	36.56	0.04	2.79	0.38	0.14	0.04	0.03	0.1	0.01	0.06
		(C) 1/4" - 3/8"	12044-47-3	2.58	1.02	45.46	36.84	0.04	3.2	0.42	0.14	0.03	0.03	0.1	0.01	0.06
		(C) 1/4" - 3/8"	12044-48-3	2.7	1.03	45.66	35.91	0.05	3.67	0.4	0.14	0.04	0.04	0.11	0.01	0.06
		Average		2.640	1.007	45.807	36.437	0.043	3.220	0.400	0.140	0.037	0.033	0.103	0.010	0.060

18 Month Data															
	Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
18 Month I															
Control	4-7 (A) 0-1/8"	12044-49-1	2.63	1.32	64.6	27.86	0.00	2.81	0.17	0.15	0.09	0.04	0.26	0.01	0.07
	4-10 (A) 0-1/8"	12044-50-1	2.7	1.16	66.16	26.54	0.00	2.76	0.17	0.16	0.04	0.05	0.19	0.01	0.07
	4-11 (A) 0-1/8"	12044-51-1	2.61	1.16	64.64	28.28	0.00	2.68	0.15	0.15	0.03	0.04	0.17	0.01	0.07
	Average		2.65	1.21	65.13	27.56	0.00	2.75	0.16	0.15	0.05	0.04	0.21	0.01	0.07
No Exposure/Reference	4-7 (B) 1/8" - 1/4"	12044-49-2	2.72	1.22	57.6	34.69	0.01	2.98	0.29	0.16	0.06	0.04	0.16	0.01	0.07
	4-10 (B) 1/8" - 1/4"	12044-50-2	2.59	1.10	56.37	36.18	0.00	3.05	0.3	0.15	0.03	0.04	0.11	0.01	0.07
	4-11 (B) 1/8" - 1/4"	12044-51-2	2.69	1.16	56.14	36.14	0.02	3.10	0.32	0.16	0.04	0.04	0.12	0.01	0.07
	Average		2.67	1.16	56.70	35.67	0.01	3.04	0.30	0.16	0.04	0.04	0.13	0.01	0.07
Hycrete	4-7 (C) 1/4" - 3/8"	12044-49-3	2.73	1.19	54.26	37.83	0.02	3.17	0.35	0.16	0.06	0.04	0.14	0.01	0.07
	4-10 (C) 1/4" - 3/8"	12044-50-3	2.78	1.17	49.33	42.29	0.04	3.55	0.45	0.17	0.03	0.04	0.09	0.01	0.06
	4-11 (C) 1/4" - 3/8"	12044-51-3	2.77	1.13	54.39	37.57	0.02	3.33	0.36	0.17	0.04	0.04	0.11	0.01	0.07
	Average		2.76	1.16	52.66	39.23	0.03	3.35	0.39	0.17	0.04	0.04	0.11	0.01	0.07

18 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Above Water Line	Control	1-7 (A) 0-1/8"	12044-55-1	2.69	1.12	68.89	23.94	0.00	2.75	0.10	0.16	0.03	0.05	0.18	0.01	0.08
		1-10 (A) 0-1/8"	12044-56-1	2.64	1.04	65.23	27.49	0.00	2.97	0.17	0.15	0.05	0.04	0.13	0.01	0.08
		1-11 (A) 0-1/8"	12044-57-1	2.74	1.10	65.24	27.36	0.00	2.86	0.20	0.17	0.04	0.05	0.14	0.01	0.07
		Average		2.69	1.09	66.45	26.26	0.00	2.86	0.16	0.16	0.04	0.05	0.15	0.01	0.08
		1-7 (B) 1/8" - 1/4"	12044-55-2	2.85	1.11	60.75	31.64	0.00	2.91	0.3	0.16	0.03	0.04	0.13	0.01	0.07
	Hycrete	1-10 (B) 1/8" - 1/4"	12044-56-2	2.65	1.07	53.34	38.77	0.02	3.39	0.33	0.16	0.05	0.04	0.09	0.01	0.07
		1-11 (B) 1/8" - 1/4"	12044-57-2	2.6	1.07	57.9	34.8	0.00	2.92	0.29	0.16	0.04	0.04	0.11	0.01	0.07
		Average		2.70	1.08	57.33	35.07	0.01	3.07	0.31	0.16	0.04	0.04	0.11	0.01	0.07
		1-7 (C) 1/4" - 3/8"	12044-55-3	2.95	1.10	52.84	39.24	0.03	2.96	0.47	0.17	0.04	0.04	0.09	0.01	0.06
		1-10 (C) 1/4" - 3/8"	12044-56-3	2.76	1.14	47.59	44.26	0.04	3.35	0.47	0.17	0.05	0.04	0.07	0.01	0.06
		1-11 (C) 1/4" - 3/8"	12044-57-3	2.75	1.11	50.10	41.23	0.04	3.94	0.44	0.17	0.04	0.04	0.08	0.01	0.07
		Average		2.82	1.12	50.18	41.58	0.04	3.42	0.46	0.17	0.04	0.04	0.08	0.01	0.06
Below Water Line	Control	H1-7 (A) 0-1/8"	12044-58-1	2.82	1.12	63.68	28.84	0.00	2.86	0.21	0.16	0.05	0.05	0.14	0.01	0.08
		H1-10 (A) 0-1/8"	12044-59-1	2.86	1.12	65.81	26.54	0.00	2.98	0.18	0.17	0.05	0.05	0.14	0.01	0.08
		H1-11 (A) 0-1/8"	12044-60-1	2.82	1.09	67.45	24.94	0.00	3.03	0.16	0.16	0.07	0.05	0.14	0.01	0.08
		Average		2.83	1.11	65.65	26.77	0.00	2.96	0.18	0.16	0.06	0.05	0.14	0.01	0.08
		H1-7 (B) 1/8" - 1/4"	12044-58-2	2.85	1.10	53.81	38.26	0.00	3.14	0.42	0.16	0.06	0.04	0.10	0.01	0.07
	Hycrete	H1-10 (B) 1/8" - 1/4"	12044-59-2	2.76	1.04	58.04	34.28	0.00	3.14	0.31	0.16	0.06	0.04	0.09	0.01	0.07
		H1-11 (B) 1/8" - 1/4"	12044-60-2	2.82	1.09	61.50	30.52	0.00	3.31	0.29	0.16	0.07	0.04	0.11	0.01	0.07
		Average		2.81	1.08	57.78	34.35	0.00	3.20	0.34	0.16	0.06	0.04	0.10	0.01	0.07
		H1-7 (C) 1/4" - 3/8"	12044-58-3	2.85	1.14	49.18	42.50	0.02	3.41	0.48	0.16	0.07	0.04	0.09	0.01	0.07
		H1-10 (C) 1/4" - 3/8"	12044-59-3	2.88	1.09	54.26	37.46	0.03	3.45	0.41	0.16	0.05	0.04	0.09	0.01	0.07
		H1-11 (C) 1/4" - 3/8"	12044-60-3	2.86	1.12	53.23	38.42	0.05	3.48	0.40	0.17	0.08	0.04	0.08	0.01	0.07
		Average		2.86	1.12	52.22	39.46	0.03	3.45	0.43	0.16	0.07	0.04	0.09	0.01	0.07

18 Month Data

		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
At Water Line	Control	2-7 (A) 0-1/8"	12044-61-1	2.78	1.17	68.40	23.88	0.00	3.19	0.12	0.15	0.02	0.04	0.16	0.01	0.07
		2-10 (A) 0-1/8"	12044-62-1	2.59	1.07	71.91	21.15	0.00	2.75	0.08	0.14	0.03	0.04	0.18	0.01	0.07
		2-11 (A) 0-1/8"	12044-63-1	2.76	1.19	67.49	25.11	0.00	2.84	0.13	0.15	0.03	0.04	0.18	0.02	0.07
		Average		2.71	1.14	69.27	23.38	0.00	2.93	0.11	0.15	0.03	0.04	0.17	0.01	0.07
		2-7 (B) 1/8" - 1/4"	12044-61-2	2.72	1.08	58.69	33.48	0.00	3.38	0.26	0.15	0.02	0.04	0.11	0.01	0.06
	Control	2-10 (B) 1/8" - 1/4"	12044-62-2	2.91	1.09	62.63	29.47	0.00	3.21	0.26	0.16	0.03	0.04	0.12	0.01	0.06
		2-11 (B) 1/8" - 1/4"	12044-63-2	2.64	1.08	56.44	36.39	0.01	2.79	0.26	0.15	0.03	0.04	0.09	0.01	0.07
		Average		2.76	1.08	59.25	33.11	0.00	3.13	0.26	0.15	0.03	0.04	0.11	0.01	0.06
	At Water Line	2-7 (C) 1/4" - 3/8"	12044-61-3	2.72	1.08	55.24	36.96	0.02	3.29	0.30	0.15	0.03	0.04	0.10	0.01	0.07
		2-10 (C) 1/4" - 3/8"	12044-62-3	2.96	1.15	57.19	34.73	0.04	3.17	0.37	0.16	0.03	0.04	0.09	0.01	0.06
		2-11 (C) 1/4" - 3/8"	12044-63-3	2.74	1.12	52.83	39.61	0.05	2.92	0.34	0.16	0.04	0.04	0.08	0.01	0.07
		Average		2.81	1.12	55.09	37.10	0.04	3.13	0.34	0.16	0.03	0.04	0.09	0.01	0.07
Hycrete	Control	H2-7 (A) 0-1/8"	12044-64-1	2.75	1.16	70.15	22.44	0.00	2.89	0.10	0.14	0.03	0.04	0.20	0.02	0.07
		H4-11 (A) 0-1/8"	12044-65-1	2.71	1.14	69.19	23.53	0.00	2.82	0.13	0.14	0.04	0.04	0.19	0.01	0.07
		H2-11 (A) 0-1/8"	12044-66-1	2.74	1.24	68.09	24.41	0.00	2.90	0.11	0.14	0.04	0.04	0.20	0.01	0.07
		Average		2.73	1.18	69.14	23.46	0.00	2.87	0.11	0.14	0.04	0.04	0.20	0.01	0.07
		H2-7 (B) 1/8" - 1/4"	12044-64-2	2.77	1.07	58.52	33.77	0.01	3.17	0.29	0.16	0.03	0.04	0.10	0.01	0.06
	Hycrete	H4-11 (B) 1/8" - 1/4"	12044-65-2	2.83	1.08	60.21	31.79	0.00	3.42	0.27	0.16	0.03	0.04	0.11	0.01	0.07
		H2-11 (B) 1/8" - 1/4"	12044-66-2	2.96	1.18	58.16	33.44	0.01	3.48	0.32	0.16	0.05	0.04	0.13	0.01	0.07
		Average		2.85	1.11	58.96	33.00	0.01	3.36	0.29	0.16	0.04	0.04	0.11	0.01	0.07
	At Water Line	H2-7 (C) 1/4" - 3/8"	12044-64-3	2.82	1.10	50.64	41.12	0.04	3.47	0.44	0.16	0.04	0.04	0.07	0.01	0.06
		H4-11 (C) 1/4" - 3/8"	12044-65-3	2.86	1.12	54.69	36.84	0.02	3.7	0.34	0.16	0.04	0.04	0.10	0.01	0.07
		H2-11 (C) 1/4" - 3/8"	12044-66-3	3.12	1.21	51.54	39.14	0.05	4.02	0.50	0.17	0.05	0.04	0.09	0.01	0.07
		Average		2.93	1.14	52.29	39.03	0.04	3.73	0.43	0.16	0.04	0.04	0.09	0.01	0.07

18 Month Data

		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Submerged	Control	3-7 (A) 0-1/8"	12044-67-1	2.86	1.21	67.94	23.98	0.00	3.36	0.15	0.15	0.05	0.04	0.19	0.02	0.07
		3-10 (A) 0-1/8"	12044-68-1	2.76	1.18	63.66	28.75	0.00	3.00	0.18	0.15	0.03	0.04	0.16	0.01	0.07
		3-11 (A) 0-1/8"	12044-69-1	2.94	1.28	69.60	22.11	0.00	3.31	0.13	0.15	0.06	0.05	0.22	0.08	0.07
		Average		2.85	1.22	67.07	24.95	0.00	3.22	0.15	0.15	0.05	0.04	0.19	0.04	0.07
		3-7 (B) 1/8" - 1/4"	12044-67-2	2.65	1.09	59.22	32.70	0.00	3.70	0.22	0.15	0.04	0.04	0.11	0.01	0.07
	3-10 (B) 1/8" - 1/4"	3-10 (B) 1/8" - 1/4"	12044-68-2	2.85	1.11	53.76	38.20	0.03	3.28	0.38	0.16	0.03	0.04	0.09	0.01	0.07
		3-11 (B) 1/8" - 1/4"	12044-69-2	2.81	1.06	62.78	29.34	0.00	3.35	0.24	0.15	0.04	0.04	0.12	0.02	0.06
		Average		2.77	1.09	58.59	33.41	0.01	3.44	0.28	0.15	0.04	0.04	0.11	0.01	0.07
	3-7 (C) 1/4" - 3/8"	3-7 (C) 1/4" - 3/8"	12044-67-3	2.86	1.13	51.02	39.83	0.06	4.30	0.41	0.17	0.04	0.04	0.08	0.01	0.07
		3-10 (C) 1/4" - 3/8"	12044-68-3	2.79	1.08	52.89	38.94	0.04	3.49	0.38	0.16	0.04	0.04	0.08	0.01	0.06
		3-11 (C) 1/4" - 3/8"	12044-69-3	2.67	1.03	58.44	34.07	0.01	3.15	0.25	0.15	0.03	0.04	0.09	0.01	0.06
		Average		2.77	1.08	54.12	37.61	0.04	3.65	0.35	0.16	0.04	0.04	0.08	0.01	0.06
Hycrete	H3-7 (A) 0-1/8"	H3-7 (A) 0-1/8"	12044-70-1	3.03	1.31	71.66	20.07	0.00	3.23	0.09	0.14	0.06	0.05	0.26	0.02	0.08
		H3-10 (A) 0-1/8"	12044-71-1	2.96	1.19	65.68	26.50	0.00	3.01	0.16	0.15	0.05	0.05	0.17	0.01	0.08
		H3-11 (A) 0-1/8"	12044-72-1	2.86	1.20	70.28	21.76	0.00	3.25	0.11	0.15	0.05	0.04	0.20	0.02	0.07
		Average		2.95	1.23	69.21	22.78	0.00	3.16	0.12	0.15	0.05	0.05	0.21	0.02	0.08
		H3-7 (B) 1/8" - 1/4"	12044-70-2	2.84	1.08	62.82	29.23	0.00	3.37	0.21	0.15	0.04	0.04	0.13	0.01	0.07
	H3-10 (B) 1/8" - 1/4"	H3-10 (B) 1/8" - 1/4"	12044-71-2	2.6	0.94	52.08	33.02	0.00	2.77	0.28	0.14	0.06	0.04	0.09	0.01	0.06
		H3-11 (B) 1/8" - 1/4"	12044-72-2	2.91	1.12	59.34	32.10	0.00	3.81	0.29	0.16	0.05	0.04	0.12	0.01	0.07
		Average		2.78	1.05	58.08	31.45	0.00	3.32	0.26	0.15	0.05	0.04	0.11	0.01	0.07
	H3-7 (C) 1/4" - 3/8"	H3-7 (C) 1/4" - 3/8"	12044-70-3	2.89	1.11	52.68	39.01	0.03	3.41	0.41	0.16	0.04	0.04	0.09	0.01	0.07
		H3-10 (C) 1/4" - 3/8"	12044-71-3	2.92	1.13	54.47	37.40	0.02	3.25	0.4	0.16	0.05	0.04	0.10	0.01	0.07
		H3-11 (C) 1/4" - 3/8"	12044-72-3	2.84	1.09	55.27	36.22	0.01	3.83	0.31	0.16	0.05	0.04	0.10	0.01	0.07
		Average		2.88	1.11	54.14	37.54	0.02	3.50	0.37	0.16	0.05	0.04	0.10	0.01	0.07

24 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
18 Month I																
Control	(A) 0-1/8"	10244-73/1	2.68	1.07	65.66	27.29	0	2.73	0.11	0.16	0.03	0.05	0.14	0.01	0.08	
	(A) 0-1/8"	12044-74/1	2.7	1.09	66.72	25.94	0	2.89	0.14	0.16	0.07	0.05	0.14	0.03	0.08	
	(A) 0-1/8"	12044-75/1	2.76	1.13	63.59	28.97	0	2.89	0.17	0.16	0.04	0.05	0.14	0.02	0.08	
	Average		2.713	1.097	65.323	27.400	0.000	2.837	0.140	0.160	0.047	0.050	0.140	0.020	0.080	
	(B) 1/8" - 1/4"	12044-73/2	2.530	1.010	57.860	35.230	0.000	2.770	0.210	0.160	0.030	0.040	0.090	0.010	0.070	
	(B) 1/8" - 1/4"	12044-74/2	2.790	1.070	55.810	33.350	0.030	3.250	0.290	0.160	0.040	0.040	0.090	0.020	0.070	
	(B) 1/8" - 1/4"	12044-75/2	2.730	1.050	58.320	34.200	0.020	3.020	0.260	0.160	0.040	0.040	0.090	0.010	0.070	
	Average		2.683	1.043	57.330	34.260	0.017	3.013	0.253	0.160	0.037	0.040	0.090	0.013	0.070	
	(C) 1/4" - 3/8"	12044-73/3	2.650	1.030	52.050	40.560	0.040	2.970	0.330	0.160	0.030	0.040	0.070	0.010	0.070	
	(C) 1/4" - 3/8"	10044-74/3	2.790	1.080	53.640	38.500	0.040	3.160	0.390	0.170	0.040	0.040	0.080	0.010	0.070	
	(C) 1/4" - 3/8"	12044-75/3	2.660	1.130	49.230	43.070	0.070	3.080	0.350	0.170	0.040	0.040	0.080	0.010	0.070	
	Average		2.700	1.080	51.640	40.710	0.050	3.070	0.357	0.167	0.037	0.040	0.077	0.010	0.070	
Hycrete	(A) 0-1/8"	12044-76/1	2.93	1.16	64.56	27.67	0	2.96	0.21	0.17	0.05	0.05	0.14	0.01	0.08	
	(A) 0-1/8"	12044-77/1	2.79	1.1	65.52	26.68	0	3.19	0.18	0.22	0.06	0.05	0.13	0.01	0.08	
	(A) 0-1/8"	12044-78/1	2.77	1.12	67	25.6	0	2.85	0.17	0.16	0.05	0.05	0.15	0.01	0.08	
	Average		2.830	1.127	65.693	26.650	0.000	3.000	0.187	0.183	0.053	0.050	0.140	0.010	0.080	
	(B) 1/8" - 1/4"	12044-76/2	2.8	1.08	56.43	36.05	0.02	2.85	0.36	0.17	0.05	0.04	0.09	0.01	0.07	
	(B) 1/8" - 1/4"	12044-77/2	2.85	1.08	57.42	34.48	0	3.38	0.34	0.17	0.08	0.04	0.09	0.01	0.07	
	(B) 1/8" - 1/4"	12044-78/2	2.73	1.09	62.23	29.91	0	3.31	0.27	0.15	0.05	0.04	0.13	0.01	0.07	
	Average		2.793	1.083	58.693	33.480	0.007	3.180	0.323	0.163	0.060	0.040	0.103	0.010	0.070	
	(C) 1/4" - 3/8"	12044-76/3	2.97	1.07	52.02	39.87	0.04	3.12	0.5	0.17	0.05	0.04	0.07	0.01	0.07	
	(C) 1/4" - 3/8"	12044-77/3	2.93	1.16	55.13	36.59	0.05	3.28	0.38	0.17	0.08	0.04	0.1	0.01	0.07	
	(C) 1/4" - 3/8"	12044-78/3	2.96	1.15	55.13	36.14	0.03	3.72	0.42	0.17	0.06	0.04	0.09	0.01	0.07	
	Average		2.953	1.127	54.093	37.533	0.040	3.373	0.433	0.170	0.063	0.040	0.087	0.010	0.070	

24 Month Data

		<u>Sample</u>	<u>Sample</u>	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Control	(A) 0-1/8"	12044-79/1	2.77	1.11	65.82	26.52	0	3.08	0.22	0.16	0.05	0.05	0.15	0.01	0.07	
	(A) 0-1/8"	12044-80/1	2.62	1.03	65.64	27.14	0	2.91	0.21	0.15	0.04	0.04	0.13	0.01	0.07	
	(A) 0-1/8"	12044-81/1	2.6	1.01	66.57	26.46	0	2.77	0.17	0.15	0.03	0.04	0.12	0.01	0.07	
	Average		2.663	1.050	66.010	26.707	0.000	2.920	0.200	0.153	0.040	0.043	0.133	0.010	0.070	
	(B) 1/8" - 1/4"	12044-79/2	2.88	1.08	58.43	33.5	0.02	3.32	0.36	0.17	0.04	0.04	0.08	0.01	0.07	
	(B) 1/8" - 1/4"	12044-80/2	2.51	0.97	59.05	33.8	0	3	0.28	0.14	0.04	0.04	0.1	0.01	0.06	
	(B) 1/8" - 1/4"	12044-81/2	2.81	1.12	52.71	39.33	0.04	3.2	0.41	0.17	0.03	0.04	0.08	0.01	0.07	
	Average		2.733	1.057	56.730	35.543	0.020	3.173	0.350	0.160	0.037	0.040	0.087	0.010	0.067	
	(C) 1/4" - 3/8"	12044-79/3	2.75	1.05	54.67	37.46	0.01	3.27	0.42	0.16	0.04	0.04	0.08	0.01	0.06	
Hycrete	(C) 1/4" - 3/8"	12044-80/3	2.68	1.08	53.54	38.51	0.03	3.38	0.37	0.16	0.05	0.04	0.08	0.01	0.07	
	(C) 1/4" - 3/8"	12044-81/3	2.87	1.12	49.27	42.49	0.03	3.34	0.51	0.17	0.03	0.04	0.07	0.01	0.06	
	Average		2.767	1.083	52.493	39.487	0.023	3.330	0.433	0.163	0.040	0.040	0.077	0.010	0.063	
	(A) 0-1/8"	12044-82/1	2.78	1.28	64.65	27.67	0	2.9	0.17	0.16	0.04	0.05	0.2	0.02	0.08	
	(A) 0-1/8"	12044-83/1	2.910	1.200	63.660	28.160	0.000	3.310	0.230	0.170	0.070	0.050	0.140	0.020	0.080	
	(A) 0-1/8"	12044-84/1	2.770	1.220	66.250	25.970	0.000	3.060	0.180	0.160	0.060	0.050	0.190	0.020	0.080	
	Average		2.820	1.233	64.853	27.267	0.000	3.090	0.193	0.163	0.057	0.050	0.177	0.020	0.080	
	(B) 1/8" - 1/4"	12044-82/2	2.740	1.090	55.230	36.960	0.000	3.210	0.360	0.160	0.040	0.040	0.090	0.010	0.070	
	(B) 1/8" - 1/4"	12044-83/2	2.880	1.150	53.050	38.590	0.020	3.430	0.420	0.170	0.080	0.040	0.090	0.010	0.070	
	(B) 1/8" - 1/4"	12044-84/2	2.850	1.150	57.340	34.260	0.010	3.580	0.340	0.170	0.060	0.050	0.100	0.010	0.070	
	Average		2.823	1.130	55.207	36.603	0.010	3.407	0.373	0.167	0.060	0.043	0.093	0.010	0.070	
	(C) 1/4" - 3/8"	12044-82/3	2.790	1.230	50.030	41.630	0.050	3.390	0.450	0.170	0.040	0.040	0.100	0.010	0.070	
	(C) 1/4" - 3/8"	12044-83/3	2.940	1.100	48.860	42.700	0.040	3.410	0.530	0.170	0.070	0.040	0.060	0.010	0.070	
	(C) 1/4" - 3/8"	12044-84/3	2.900	1.120	52.340	39.230	0.060	3.480	0.440	0.180	0.060	0.040	0.080	0.010	0.070	
	Average		2.877	1.150	50.410	41.187	0.050	3.427	0.473	0.173	0.057	0.040	0.080	0.010	0.070	

24 Month Data

		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
At Water Line	Control	(A) 0-1/8"	12044-85/1	2.72	1.09	69.12	23.69	0	2.7	0.17	0.15	0.06	0.05	0.17	0.01	0.07
		(A) 0-1/8"	12044-86/1	2.99	1.35	65.45	26.24	0.02	3.25	0.16	0.17	0.03	0.06	0.19	0.01	0.08
		(A) 0-1/8"	12044-87/1	2.82	1.22	69.1	23.27	0	2.96	0.14	0.15	0.02	0.05	0.19	0.02	0.07
		Average		2.84	1.22	67.89	24.40	0.01	2.97	0.16	0.16	0.04	0.05	0.18	0.01	0.07
		(B) 1/8" - 1/4"	12044-85/2	2.9	1.16	59.04	32.89	0.01	3.16	0.38	0.17	0.05	0.04	0.12	0.01	0.07
	Control	(B) 1/8" - 1/4"	12044-86/2	2.82	1.14	54.45	37.69	0.07	3.1	0.31	0.18	0.04	0.04	0.09	0.01	0.07
		(B) 1/8" - 1/4"	12044-87/2	3.01	1.15	59.76	32.04	0.02	3.24	0.38	0.16	0.03	0.04	0.1	0.01	0.06
		Average		2.91	1.15	57.75	34.21	0.03	3.17	0.36	0.17	0.04	0.04	0.10	0.01	0.07
	Control	(C) 1/4" - 3/8"	12044-85/3	3.08	1.2	51.56	39.63	0.04	3.52	0.55	0.17	0.05	0.04	0.09	0.01	0.07
		(C) 1/4" - 3/8"	12044-86/3	2.79	1.09	49.93	42.02	0.07	3.31	0.42	0.16	0.04	0.04	0.07	0.01	0.06
		(C) 1/4" - 3/8"	12044-87/3	3.19	1.19	54.58	36.13	0.06	3.92	0.52	0.18	0.04	0.04	0.09	0.01	0.07
		Average		3.02	1.16	52.02	39.26	0.06	3.58	0.50	0.17	0.04	0.04	0.08	0.01	0.07
Hycrete	Hycrete	(A) 0-1/8"	12044-88/1	3	1.32	63.42	27.84	0.01	3.6	0.25	0.17	0.07	0.05	0.18	0.02	0.08
		(A) 0-1/8"	12044-89/1	3.01	1.35	63.13	28.74	0	3.01	0.22	0.16	0.04	0.05	0.2	0.01	0.08
		(A) 0-1/8"	12044-90/1	2.86	1.25	65.02	26.92	0	3.26	0.17	0.15	0.04	0.05	0.19	0.01	0.07
		Average		2.957	1.307	63.857	27.833	0.003	3.290	0.213	0.160	0.050	0.050	0.190	0.013	0.077
		(B) 1/8" - 1/4"	12044-88/2	2.99	1.16	54.83	36	0.04	4.08	0.46	0.17	0.07	0.04	0.09	0.01	0.07
	Hycrete	(B) 1/8" - 1/4"	12044-89/2	3.04	1.19	61.23	30.77	0	3.03	0.29	0.16	0.04	0.04	0.13	0.01	0.07
		(B) 1/8" - 1/4"	12044-90/2	2.86	1.2	55.22	36.4	0.03	3.51	0.34	0.17	0.04	0.04	0.11	0.01	0.07
		Average		2.963	1.183	57.093	34.390	0.023	3.540	0.363	0.167	0.050	0.040	0.110	0.010	0.070
	Hycrete	(C) 1/4" - 3/8"	12044-88/3	3.01	1.17	49.98	40.8	0.07	4.00	0.53	0.17	0.07	0.04	0.08	0.01	0.07
		(C) 1/4" - 3/8"	12044-89/3	3.1	1.25	57.13	34.52	0.07	3.12	0.37	0.17	0.04	0.04	0.11	0.01	0.07
		(C) 1/4" - 3/8"	12044-90/3	2.94	1.23	48.65	42.61	0.07	3.58	0.49	0.18	0.04	0.04	0.09	0.01	0.07
		Average		3.017	1.217	51.920	39.310	0.070	3.567	0.463	0.173	0.050	0.040	0.093	0.010	0.070

24 Month Data																
		Sample	Sample	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
Submerged	Control	(A) 0-1/8"	12044-91/1	2.64	1.07	60.53	31.96	0.01	3.16	0.22	0.15	0.03	0.04	0.12	0.01	0.06
		(A) 0-1/8"	12044-92/1	2.84	1.24	70.74	21.55	0	2.96	0.1	0.15	0.03	0.05	0.24	0.02	0.07
		(A) 0-1/8"	12044-93/1	2.84	1.17	65.28	26.95	0	3.08	0.19	0.15	0.03	0.04	0.19	0.02	0.06
		Average		2.773	1.160	65.517	26.820	0.003	3.067	0.170	0.150	0.030	0.043	0.183	0.017	0.063
		(B) 1/8" - 1/4"	12044-91/2	2.82	1.29	68.59	23.43	0	3.2	0.12	0.15	0.04	0.05	0.22	0.02	0.07
		(B) 1/8" - 1/4"	12044-92/2	2.79	1.11	61.52	30.7	0.02	3.18	0.25	0.15	0.03	0.04	0.13	0.01	0.07
		(B) 1/8" - 1/4"	12044-93/3	2.84	1.25	52.73	39.05	0.11	3.23	0.39	0.17	0.03	0.04	0.09	0.01	0.06
		Average		2.817	1.217	60.947	31.060	0.043	3.203	0.253	0.157	0.033	0.043	0.147	0.013	0.067
		(C) 1/4" - 3/8"	12044-91/3	2.8	1.49	48.38	43.05	0.06	6.22	0.44	0.17	0.04	0.04	0.23	0.01	0.08
		(C) 1/4" - 3/8"	12044-92/3	2.78	1.11	56.41	35.59	0.03	3.35	0.33	0.16	0.03	0.04	0.1	0.01	0.07
		(C) 1/4" - 3/8"	12044-93/2	2.78	1.19	60.5	31.81	0	3.01	0.27	0.16	0.03	0.04	0.15	0.01	0.06
		Average		2.787	1.263	55.097	36.817	0.030	4.193	0.347	0.163	0.033	0.040	0.160	0.010	0.070
Hycrete	Hycrete	(A) 0-1/8"	12044-94/1	2.98	1.3	67.73	24.07	0	3.18	0.18	0.16	0.05	0.05	0.22	0.02	0.07
		(A) 0-1/8"	12044-95/1	2.84	1.34	67.91	24.27	0	2.93	0.13	0.15	0.05	0.05	0.25	0.02	0.07
		(A) 0-1/8"	12044-96/1	3.09	1.37	64.75	26.67	0	3.34	0.22	0.17	0.05	0.05	0.2	0.02	0.08
		Average		2.970	1.337	66.797	25.003	0.000	3.150	0.177	0.160	0.050	0.050	0.223	0.020	0.073
		(B) 1/8" - 1/4"	12044-94/2	3.08	1.24	55.33	36.05	0.01	3.41	0.4	0.18	0.06	0.04	0.12	0.01	0.07
		(B) 1/8" - 1/4"	12044-95/2	2.77	1.19	61.25	31.15	0	2.93	0.22	0.16	0.04	0.04	0.16	0.01	0.07
		(B) 1/8" - 1/4"	12044-96/2	3.02	1.22	54.68	36.06	0.05	3.59	0.41	0.17	0.04	0.04	0.1	0.01	0.07
		Average		2.957	1.217	57.087	34.420	0.020	3.310	0.343	0.170	0.047	0.040	0.127	0.010	0.070
		(C) 1/4" - 3/8"	12044-94/3	3.12	1.15	48.02	43.14	0.04	3.57	0.56	0.17	0.07	0.04	0.07	0.01	0.06
		(C) 1/4" - 3/8"	12044-95/3	2.82	1.09	57.27	34.92	0.02	3.15	0.3	0.16	0.04	0.04	0.09	0.01	0.07
		(C) 1/4" - 3/8"	12044-96/3	3.1	1.24	50.16	40.84	0.08	3.64	0.5	0.17	0.05	0.04	0.09	0.01	0.07
		Average		3.013	1.160	51.817	39.633	0.047	3.453	0.453	0.167	0.053	0.040	0.083	0.010	0.067

6 Months

<u>Sample (Average of 3)</u>	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
No Exposure/Control (A) 0-1/8"	2.844	1.175	63.074	26.568	0.016	2.852	0.186	0.160	0.051	0.051	0.194	0.012	0.077
No Exposure/Control (B) 1/8"- 1/4"	2.697	1.081	52.613	31.555	0.047	2.815	0.271	0.149	0.041	0.044	0.144	0.009	0.068
No Exposure/Control (C) 1/4"-3/8"	2.557	1.006	43.324	36.230	0.057	2.765	0.383	0.141	0.033	0.039	0.110	0.008	0.060
No Exposure/Hycrete (A) 0-1/8"	2.776	1.125	58.740	27.848	0.009	2.797	0.224	0.159	0.064	0.048	0.165	0.011	0.077
No Exposure/Hycrete (B) 1/8"- 1/4"	2.655	0.980	46.597	34.049	0.054	2.970	0.374	0.143	0.059	0.040	0.111	0.009	0.064
No Exposure/Hycrete (C) 1/4"-3/8"	2.661	0.953	41.368	36.939	0.074	3.016	0.454	0.141	0.060	0.039	0.091	0.008	0.062
Above Water Line/Control (A) 0-1/8"	2.768	1.105	62.672	26.689	0.013	2.710	0.198	0.158	0.051	0.049	0.167	0.014	0.076
Above Water Line/Control (B) 1/8"- 1/4"	2.626	1.009	50.748	32.218	0.036	2.633	0.305	0.145	0.038	0.042	0.125	0.009	0.064
Above Water Line/Control (C) 1/4"-3/8"	2.589	0.963	44.200	35.949	0.053	2.661	0.397	0.140	0.037	0.039	0.101	0.008	0.060
Above Water Line/Hycrete (A) 0-1/8"	2.753	1.089	60.681	27.199	0.000	2.578	0.236	0.156	0.061	0.048	0.167	0.012	0.075
Above Water Line/Hycrete (B) 1/8"- 1/4"	2.722	1.048	55.592	29.547	0.016	2.699	0.261	0.144	0.051	0.044	0.150	0.010	0.068
Above Water Line/Hycrete (C) 1/4"-3/8"	2.637	1.010	46.303	34.440	0.053	2.740	0.357	0.142	0.048	0.039	0.119	0.008	0.064
At Water Line/Control (A) 0-1/8"	2.876	1.204	66.011	23.338	0.000	2.785	0.094	0.153	0.025	0.058	0.211	0.015	0.071
At Water Line/Control (B) 1/8"- 1/4"	2.638	1.086	53.448	30.874	0.037	2.774	0.220	0.146	0.026	0.045	0.145	0.010	0.064
At Water Line/Control (C) 1/4"-3/8"	2.632	1.075	44.851	35.373	0.061	2.713	0.359	0.143	0.027	0.041	0.145	0.008	0.062
At Water Line/Hycrete (A) 0-1/8"	3.010	1.275	63.756	25.567	0.000	2.973	0.142	0.162	0.037	0.061	0.195	0.015	0.073
At Water Line/Hycrete (B) 1/8"- 1/4"	2.723	1.064	49.475	32.573	0.049	2.754	0.277	0.144	0.036	0.050	0.129	0.012	0.065
At Water Line/Hycrete (C) 1/4"-3/8"	2.661	0.996	44.822	35.206	0.066	2.759	0.332	0.144	0.041	0.042	0.108	0.009	0.064
Submerged/Control (A) 0-1/8"	3.035	1.358	70.193	22.505	0.000	2.961	0.099	0.154	0.026	0.055	0.253	0.016	0.079
Submerged/Control (B) 1/8"- 1/4"	2.667	1.076	51.559	31.528	0.059	2.612	0.255	0.144	0.024	0.044	0.144	0.010	0.067
Submerged/Control (C) 1/4"-3/8"	2.660	1.029	45.652	34.659	0.083	2.784	0.336	0.148	0.031	0.043	0.111	0.009	0.064
Submerged/Hycrete (A) 0-1/8"	3.153	1.408	67.341	23.536	0.000	3.135	0.139	0.163	0.036	0.057	0.217	0.017	0.079
Submerged/Hycrete (B) 1/8"- 1/4"	2.777	1.127	49.911	31.940	0.074	3.055	0.295	0.144	0.035	0.051	0.132	0.010	0.065
Submerged/Hycrete (C) 1/4"-3/8"	2.700	1.068	44.501	35.217	0.088	2.950	0.342	0.143	0.037	0.042	0.109	0.009	0.064

12 Months

<u>Sample (Average of 3)</u>	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
No Exposure/Control (A) 0-1/8"	2.767	1.147	63.480	27.597	0.000	2.800	0.240	0.157	0.060	0.060	0.170	0.010	0.070
No Exposure/Control (B) 1/8"- 1/4"	2.597	1.040	51.463	33.553	0.003	2.943	0.357	0.150	0.050	0.040	0.117	0.010	0.060
No Exposure/Control (C) 1/4"-3/8"	2.603	1.020	45.653	36.073	0.030	2.907	0.437	0.143	0.040	0.037	0.110	0.010	0.060
No Exposure/Hycrete (A) 0-1/8"	2.747	1.157	60.247	28.607	0.000	2.703	0.253	0.160	0.047	0.043	0.153	0.017	0.077
No Exposure/Hycrete (B) 1/8"- 1/4"	2.637	1.030	48.127	35.170	0.017	2.707	0.433	0.150	0.040	0.037	0.107	0.017	0.063
No Exposure/Hycrete (C) 1/4"-3/8"	2.570	1.003	45.190	36.653	0.023	2.690	0.443	0.143	0.037	0.033	0.103	0.010	0.060
Above Water Line/Control (A) 0-1/8"	2.660	1.210	65.733	27.000	0.000	2.707	0.197	0.160	0.080	0.040	0.190	0.010	0.073
Above Water Line/Control (B) 1/8"- 1/4"	2.500	1.080	51.047	33.807	0.007	2.663	0.310	0.147	0.033	0.033	0.133	0.010	0.063
Above Water Line/Control (C) 1/4"-3/8"	2.397	1.030	39.437	39.450	0.060	3.110	0.427	0.137	0.040	0.033	0.100	0.010	0.057
Above Water Line/Hycrete (A) 0-1/8"	2.757	1.090	64.137	27.987	0.000	2.670	0.233	0.157	0.060	0.040	0.153	0.010	0.070
Above Water Line/Hycrete (B) 1/8"- 1/4"	2.620	1.003	49.530	35.397	0.010	2.513	0.387	0.147	0.043	0.033	0.117	0.010	0.060
Above Water Line/Hycrete (C) 1/4"-3/8"	2.487	0.940	42.933	38.163	0.030	2.497	0.423	0.140	0.043	0.033	0.100	0.010	0.053
At Water Line/Control (A) 0-1/8"	2.810	1.187	66.830	26.617	0.000	2.653	0.160	0.160	0.020	0.047	0.173	0.010	0.070
At Water Line/Control (B) 1/8"- 1/4"	2.490	0.670	34.200	35.550	0.017	1.677	0.343	0.103	0.010	0.037	0.077	0.007	0.037
At Water Line/Control (C) 1/4"-3/8"	2.557	1.000	45.300	36.653	0.057	2.767	0.353	0.143	0.023	0.040	0.110	0.010	0.060
At Water Line/Hycrete (A) 0-1/8"	2.857	1.220	66.630	26.667	0.000	2.857	0.163	0.167	0.037	0.050	0.177	0.013	0.070
At Water Line/Hycrete (B) 1/8"- 1/4"	2.723	1.050	51.460	33.940	0.003	2.963	0.360	0.150	0.047	0.040	0.107	0.010	0.060
At Water Line/Hycrete (C) 1/4"-3/8"	2.710	0.993	44.220	37.480	0.037	2.973	0.453	0.147	0.050	0.033	0.087	0.010	0.060
Submerged/Control (A) 0-1/8"	2.843	1.270	70.617	24.530	0.000	3.007	0.127	0.163	0.027	0.050	0.203	0.013	0.077
Submerged/Control (B) 1/8"- 1/4"	2.447	1.020	48.870	35.357	0.030	2.723	0.280	0.140	0.020	0.037	0.120	0.010	0.060
Submerged/Control (C) 1/4"-3/8"	2.580	1.240	45.583	36.033	0.060	3.013	0.367	0.177	0.030	0.040	0.183	0.010	0.063
Submerged/Hycrete (A) 0-1/8"	2.880	1.227	70.030	24.937	0.000	3.117	0.160	0.153	0.037	0.047	0.187	0.017	0.070
Submerged/Hycrete (B) 1/8"- 1/4"	2.730	1.053	50.530	33.547	0.017	3.263	0.357	0.147	0.040	0.040	0.123	0.010	0.060
Submerged/Hycrete (C) 1/4"-3/8"	2.640	1.007	45.807	36.437	0.043	3.220	0.400	0.140	0.037	0.033	0.103	0.010	0.060

18 Months

<u>Sample (Average of 3)</u>	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
No Exposure/Control (A) 0-1/8"	2.65	1.21	65.13	27.56	0.00	2.75	0.16	0.15	0.05	0.04	0.21	0.01	0.07
No Exposure/Control (B) 1/8"- 1/4"	2.67	1.16	56.70	35.67	0.01	3.04	0.30	0.16	0.04	0.04	0.13	0.01	0.07
No Exposure/Control (C) 1/4"-3/8"	2.76	1.16	52.66	39.23	0.03	3.35	0.39	0.17	0.04	0.04	0.11	0.01	0.07
No Exposure/Hycrete (A) 0-1/8"	2.84	1.15	60.82	31.25	0.02	3.16	0.29	0.16	0.06	0.04	0.13	0.02	0.07
No Exposure/Hycrete (B) 1/8"- 1/4"	2.87	1.18	55.98	35.62	0.03	3.51	0.35	0.17	0.07	0.04	0.12	0.01	0.07
No Exposure/Hycrete (C) 1/4"-3/8"	2.92	1.17	56.15	35.33	0.03	3.56	0.36	0.17	0.07	0.04	0.11	0.01	0.07
Above Water Line/Control (A) 0-1/8"	2.69	1.09	66.45	26.26	0.00	2.86	0.16	0.16	0.04	0.05	0.15	0.01	0.08
Above Water Line/Control (B) 1/8"- 1/4"	2.70	1.08	57.33	35.07	0.01	3.07	0.31	0.16	0.04	0.04	0.11	0.01	0.07
Above Water Line/Control (C) 1/4"-3/8"	2.82	1.12	50.18	41.58	0.04	3.42	0.46	0.17	0.04	0.04	0.08	0.01	0.06
Above Water Line/Hycrete (A) 0-1/8"	2.83	1.11	65.65	26.77	0.00	2.96	0.18	0.16	0.06	0.05	0.14	0.01	0.08
Above Water Line/Hycrete (B) 1/8"- 1/4"	2.81	1.08	57.78	34.35	0.00	3.20	0.34	0.16	0.06	0.04	0.10	0.01	0.07
Above Water Line/Hycrete (C) 1/4"-3/8"	2.86	1.12	52.22	39.46	0.03	3.45	0.43	0.16	0.07	0.04	0.09	0.01	0.07
At Water Line/Control (A) 0-1/8"	2.71	1.14	69.27	23.38	0.00	2.93	0.11	0.15	0.03	0.04	0.17	0.01	0.07
At Water Line/Control (B) 1/8"- 1/4"	2.76	1.08	59.25	33.11	0.00	3.13	0.26	0.15	0.03	0.04	0.11	0.01	0.06
At Water Line/Control (C) 1/4"-3/8"	2.81	1.12	55.09	37.10	0.04	3.13	0.34	0.16	0.03	0.04	0.09	0.01	0.07
At Water Line/Hycrete (A) 0-1/8"	2.73	1.18	69.14	23.46	0.00	2.87	0.11	0.14	0.04	0.04	0.20	0.01	0.07
At Water Line/Hycrete (B) 1/8"- 1/4"	2.85	1.11	58.96	33.00	0.01	3.36	0.29	0.16	0.04	0.04	0.11	0.01	0.07
At Water Line/Hycrete (C) 1/4"-3/8"	2.93	1.14	52.29	39.03	0.04	3.73	0.43	0.16	0.04	0.04	0.09	0.01	0.07
Submerged/Control (A) 0-1/8"	2.85	1.22	67.07	24.95	0.00	3.22	0.15	0.15	0.05	0.04	0.19	0.04	0.07
Submerged/Control (B) 1/8"- 1/4"	2.77	1.09	58.59	33.41	0.01	3.44	0.28	0.15	0.04	0.04	0.11	0.01	0.07
Submerged/Control (C) 1/4"-3/8"	2.77	1.08	54.12	37.61	0.04	3.65	0.35	0.16	0.04	0.04	0.08	0.01	0.06
Submerged/Hycrete (A) 0-1/8"	2.95	1.23	69.21	22.78	0.00	3.16	0.12	0.15	0.05	0.05	0.21	0.02	0.08
Submerged/Hycrete (B) 1/8"- 1/4"	2.78	1.05	58.08	31.45	0.00	3.32	0.26	0.15	0.05	0.04	0.11	0.01	0.07
Submerged/Hycrete (C) 1/4"-3/8"	2.88	1.11	54.14	37.54	0.02	3.50	0.37	0.16	0.05	0.04	0.10	0.01	0.07

24 Month Data

<u>Sample (Average of 3)</u>	Aluminum Oxide % (Al ₂ O ₃)	Ferric Oxide % (Fe ₂ O ₃)	Silicon Dioxide % (SiO ₂)	Calcium Oxide % (CaO)	Sulfur Trioxide % (SO ₃)	Magnesium Oxide % (MgO)	Potassium Oxide % (K ₂ O)	Titanium Dioxide % (TiO ₂)	Sodium Oxide % (Na ₂ O)	Phosphorus Pentoxide % (P ₂ O ₅)	Chromium(III) oxide % (Cr ₂ O ₃)	Zinc oxide % (ZnO)	Manganese(II) oxide % (MnO)
No Exposure/Control (A) 0-1/8"	2.713	1.175	65.323	27.400	0.000	2.837	0.140	0.160	0.047	0.050	0.140	0.020	0.080
No Exposure/Control (B) 1/8"- 1/4"	2.683	1.043	57.330	34.260	0.017	3.013	0.253	0.160	0.037	0.040	0.090	0.013	0.070
No Exposure/Control (C) 1/4"-3/8"	2.700	1.080	51.640	40.710	0.050	3.070	0.357	0.167	0.037	0.040	0.077	0.010	0.070
No Exposure/Hycrete (A) 0-1/8"	2.830	1.127	65.693	26.650	0.000	3.000	0.187	0.183	0.053	0.050	0.140	0.010	0.080
No Exposure/Hycrete (B) 1/8"- 1/4"	2.793	1.083	58.693	33.480	0.007	3.180	0.323	0.163	0.060	0.040	0.103	0.010	0.070
No Exposure/Hycrete (C) 1/4"-3/8"	2.953	1.127	54.093	37.533	0.040	3.373	0.433	0.170	0.063	0.040	0.087	0.010	0.070
Above Water Line/Control (A) 0-1/8"	2.663	1.050	66.010	26.707	0.000	2.920	0.200	0.153	0.040	0.043	0.133	0.010	0.070
Above Water Line/Control (B) 1/8"- 1/4"	2.733	1.057	56.730	35.543	0.020	3.173	0.350	0.160	0.037	0.040	0.087	0.010	0.067
Above Water Line/Control (C) 1/4"-3/8"	2.767	1.083	52.493	39.487	0.023	3.330	0.433	0.163	0.040	0.040	0.077	0.010	0.063
Above Water Line/Hycrete (A) 0-1/8"	2.820	1.233	64.853	27.267	0.000	3.090	0.193	0.163	0.057	0.050	0.177	0.020	0.080
Above Water Line/Hycrete (B) 1/8"- 1/4"	2.823	1.130	55.207	36.603	0.010	3.407	0.373	0.167	0.060	0.043	0.093	0.010	0.070
Above Water Line/Hycrete (C) 1/4"-3/8"	2.877	1.150	50.410	41.187	0.050	3.427	0.473	0.173	0.057	0.040	0.080	0.010	0.070
At Water Line/Control (A) 0-1/8"	2.843	1.220	67.890	24.400	0.007	2.970	0.157	0.157	0.037	0.053	0.183	0.013	0.073
At Water Line/Control (B) 1/8"- 1/4"	2.910	1.150	57.750	34.207	0.033	3.167	0.357	0.170	0.040	0.040	0.103	0.010	0.067
At Water Line/Control (C) 1/4"-3/8"	3.020	1.160	52.023	39.260	0.057	3.583	0.497	0.170	0.043	0.040	0.083	0.010	0.067
At Water Line/Hycrete (A) 0-1/8"	2.957	1.307	63.857	27.833	0.003	3.290	0.213	0.160	0.050	0.050	0.190	0.013	0.077
At Water Line/Hycrete (B) 1/8"- 1/4"	2.963	1.183	57.093	34.390	0.023	3.540	0.363	0.167	0.050	0.040	0.110	0.010	0.070
At Water Line/Hycrete (C) 1/4"-3/8"	3.017	1.217	51.920	39.310	0.070	3.567	0.463	0.173	0.050	0.040	0.093	0.010	0.070
Submerged/Control (A) 0-1/8"	2.773	1.160	65.517	26.820	0.003	3.067	0.170	0.150	0.030	0.043	0.183	0.017	0.063
Submerged/Control (B) 1/8"- 1/4"	2.817	1.217	60.947	31.060	0.043	3.203	0.253	0.157	0.033	0.043	0.147	0.013	0.067
Submerged/Control (C) 1/4"-3/8"	2.787	1.263	55.097	36.817	0.030	4.193	0.347	0.163	0.033	0.040	0.160	0.010	0.070
Submerged/Hycrete (A) 0-1/8"	2.970	1.337	66.797	25.003	0.000	3.150	0.177	0.160	0.050	0.050	0.223	0.020	0.073
Submerged/Hycrete (B) 1/8"- 1/4"	2.957	1.217	57.087	34.420	0.020	3.310	0.343	0.170	0.047	0.040	0.127	0.010	0.070
Submerged/Hycrete (C) 1/4"-3/8"	3.013	1.160	51.817	39.633	0.047	3.453	0.453	0.167	0.053	0.040	0.083	0.010	0.067

<u>Sample (Average of 3)</u>	Phosphorus Pentoxide % (P2O5)				Sulfur Trioxide % (SO3)			
	6 Months	12 Months	18 Months	24 Months	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	0.051	0.060	0.043	0.050	0.016	0.000	0.000	0.000
No Exposure/Control (B) 1/8"- 1/4"	0.044	0.040	0.040	0.040	0.047	0.003	0.010	0.017
No Exposure/Control (C) 1/4"-3/8"	0.039	0.037	0.040	0.040	0.057	0.030	0.027	0.050
No Exposure/Hycrete (A) 0-1/8"	0.048	0.043	0.040	0.050	0.009	0.000	0.020	0.000
No Exposure/Hycrete (B) 1/8"- 1/4"	0.040	0.037	0.043	0.040	0.054	0.017	0.027	0.007
No Exposure/Hycrete (C) 1/4"-3/8"	0.039	0.033	0.043	0.040	0.074	0.023	0.033	0.040
Above Water Line/Control (A) 0-1/8"	0.049	0.040	0.047	0.043	0.013	0.000	0.000	0.000
Above Water Line/Control (B) 1/8"- 1/4"	0.042	0.033	0.040	0.040	0.036	0.007	0.007	0.020
Above Water Line/Control (C) 1/4"-3/8"	0.039	0.033	0.040	0.040	0.053	0.060	0.037	0.023
Above Water Line/Hycrete (A) 0-1/8"	0.048	0.040	0.050	0.050	0.000	0.000	0.000	0.000
Above Water Line/Hycrete (B) 1/8"- 1/4"	0.044	0.033	0.040	0.043	0.016	0.010	0.000	0.010
Above Water Line/Hycrete (C) 1/4"-3/8"	0.039	0.033	0.040	0.040	0.053	0.030	0.033	0.050
At Water Line/Control (A) 0-1/8"	0.058	0.047	0.040	0.053	0.000	0.000	0.000	0.007
At Water Line/Control (B) 1/8"- 1/4"	0.045	0.037	0.040	0.040	0.037	0.017	0.003	0.033
At Water Line/Control (C) 1/4"-3/8"	0.041	0.040	0.040	0.040	0.061	0.057	0.037	0.057
At Water Line/Hycrete (A) 0-1/8"	0.061	0.050	0.040	0.050	0.000	0.000	0.000	0.003
At Water Line/Hycrete (B) 1/8"- 1/4"	0.050	0.040	0.040	0.040	0.049	0.003	0.007	0.023
At Water Line/Hycrete (C) 1/4"-3/8"	0.042	0.033	0.040	0.040	0.066	0.037	0.037	0.070
Submerged/Control (A) 0-1/8"	0.055	0.050	0.043	0.043	0.000	0.000	0.000	0.003
Submerged/Control (B) 1/8"- 1/4"	0.044	0.037	0.040	0.043	0.059	0.030	0.010	0.043
Submerged/Control (C) 1/4"-3/8"	0.043	0.040	0.040	0.040	0.083	0.060	0.037	0.030
Submerged/Hycrete (A) 0-1/8"	0.057	0.047	0.047	0.050	0.000	0.000	0.000	0.000
Submerged/Hycrete (B) 1/8"- 1/4"	0.051	0.040	0.040	0.040	0.074	0.017	0.000	0.020
Submerged/Hycrete (C) 1/4"-3/8"	0.042	0.033	0.040	0.040	0.088	0.043	0.020	0.047

<u>Sample (Average of 3)</u>	Aluminum Oxide % (Al ₂ O ₃)				Ferric Oxide % (Fe ₂ O ₃)			
	6 Months	12 Months	18 Months	24 Months	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	2.844	2.767	2.647	2.713	1.175	1.147	1.213	1.175
No Exposure/Control (B) 1/8"- 1/4"	2.697	2.597	2.667	2.683	1.081	1.040	1.160	1.043
No Exposure/Control (C) 1/4"-3/8"	2.557	2.603	2.760	2.700	1.006	1.020	1.163	1.080
No Exposure/Hycrete (A) 0-1/8"	2.776	2.747	2.840	2.830	1.125	1.157	1.150	1.127
No Exposure/Hycrete (B) 1/8"- 1/4"	2.655	2.637	2.867	2.793	0.980	1.030	1.177	1.083
No Exposure/Hycrete (C) 1/4"-3/8"	2.661	2.570	2.920	2.953	0.953	1.003	1.167	1.127
Above Water Line/Control (A) 0-1/8"	2.768	2.660	2.690	2.663	1.105	1.210	1.087	1.050
Above Water Line/Control (B) 1/8"- 1/4"	2.626	2.500	2.700	2.733	1.009	1.080	1.083	1.057
Above Water Line/Control (C) 1/4"-3/8"	2.589	2.397	2.820	2.767	0.963	1.030	1.117	1.083
Above Water Line/Hycrete (A) 0-1/8"	2.753	2.757	2.833	2.820	1.089	1.090	1.110	1.233
Above Water Line/Hycrete (B) 1/8"- 1/4"	2.722	2.620	2.810	2.823	1.048	1.003	1.077	1.130
Above Water Line/Hycrete (C) 1/4"-3/8"	2.637	2.487	2.863	2.877	1.010	0.940	1.117	1.150
At Water Line/Control (A) 0-1/8"	2.876	2.810	2.710	2.843	1.204	1.187	1.143	1.220
At Water Line/Control (B) 1/8"- 1/4"	2.638	2.490	2.757	2.910	1.086	0.670	1.083	1.150
At Water Line/Control (C) 1/4"-3/8"	2.632	2.557	2.807	3.020	1.075	1.000	1.117	1.160
At Water Line/Hycrete (A) 0-1/8"	3.010	2.857	2.733	2.957	1.275	1.220	1.180	1.307
At Water Line/Hycrete (B) 1/8"- 1/4"	2.723	2.723	2.853	2.963	1.064	1.050	1.110	1.183
At Water Line/Hycrete (C) 1/4"-3/8"	2.661	2.710	2.933	3.017	0.996	0.993	1.143	1.217
Submerged/Control (A) 0-1/8"	3.035	2.843	2.853	2.773	1.358	1.270	1.223	1.160
Submerged/Control (B) 1/8"- 1/4"	2.667	2.447	2.770	2.817	1.076	1.020	1.087	1.217
Submerged/Control (C) 1/4"-3/8"	2.660	2.580	2.773	2.787	1.029	1.240	1.080	1.263
Submerged/Hycrete (A) 0-1/8"	3.153	2.880	2.950	2.970	1.408	1.227	1.233	1.337
Submerged/Hycrete (B) 1/8"- 1/4"	2.777	2.730	2.783	2.957	1.127	1.053	1.047	1.217
Submerged/Hycrete (C) 1/4"-3/8"	2.700	2.640	2.883	3.013	1.068	1.007	1.110	1.160

<u>Sample (Average of 3)</u>	Silicon Dioxide % (SiO ₂)				Calcium Oxide % (CaO)			
	6 Months	12 Months	18 Months	24 Months	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	63.074	63.480	65.133	65.323	26.568	27.597	27.560	27.400
No Exposure/Control (B) 1/8"- 1/4"	52.613	51.463	56.703	57.330	31.555	33.553	35.670	34.260
No Exposure/Control (C) 1/4"-3/8"	43.324	45.653	52.660	51.640	36.230	36.073	39.230	40.710
No Exposure/Hycrete (A) 0-1/8"	58.740	60.247	60.817	65.693	27.848	28.607	31.247	26.650
No Exposure/Hycrete (B) 1/8"- 1/4"	46.597	48.127	55.977	58.693	34.049	35.170	35.620	33.480
No Exposure/Hycrete (C) 1/4"-3/8"	41.368	45.190	56.153	54.093	36.939	36.653	35.330	37.533
Above Water Line/Control (A) 0-1/8"	62.672	65.733	66.453	66.010	26.689	27.000	26.263	26.707
Above Water Line/Control (B) 1/8"- 1/4"	50.748	51.047	57.330	56.730	32.218	33.807	35.070	35.543
Above Water Line/Control (C) 1/4"-3/8"	44.200	39.437	50.177	52.493	35.949	39.450	41.577	39.487
Above Water Line/Hycrete (A) 0-1/8"	60.681	64.137	65.647	64.853	27.199	27.987	26.773	27.267
Above Water Line/Hycrete (B) 1/8"- 1/4"	55.592	49.530	57.783	55.207	29.547	35.397	34.353	36.603
Above Water Line/Hycrete (C) 1/4"-3/8"	46.303	42.933	52.223	50.410	34.440	38.163	39.460	41.187
At Water Line/Control (A) 0-1/8"	66.011	66.830	69.267	67.890	23.338	26.617	23.380	24.400
At Water Line/Control (B) 1/8"- 1/4"	53.448	34.200	59.253	57.750	30.874	35.550	33.113	34.207
At Water Line/Control (C) 1/4"-3/8"	44.851	45.300	55.087	52.023	35.373	36.653	37.100	39.260
At Water Line/Hycrete (A) 0-1/8"	63.756	66.630	69.143	63.857	25.567	26.667	23.460	27.833
At Water Line/Hycrete (B) 1/8"- 1/4"	49.475	51.460	58.963	57.093	32.573	33.940	33.000	34.390
At Water Line/Hycrete (C) 1/4"-3/8"	44.822	44.220	52.290	51.920	35.206	37.480	39.033	39.310
Submerged/Control (A) 0-1/8"	70.193	70.617	67.067	65.517	22.505	24.530	24.947	26.820
Submerged/Control (B) 1/8"- 1/4"	51.559	48.870	58.587	60.947	31.528	35.357	33.413	31.060
Submerged/Control (C) 1/4"-3/8"	45.652	45.583	54.117	55.097	34.659	36.033	37.613	36.817
Submerged/Hycrete (A) 0-1/8"	67.341	70.030	69.207	66.797	23.536	24.937	22.777	25.003
Submerged/Hycrete (B) 1/8"- 1/4"	49.911	50.530	58.080	57.087	31.940	33.547	31.450	34.420
Submerged/Hycrete (C) 1/4"-3/8"	44.501	45.807	54.140	51.817	35.217	36.437	37.543	39.633

<u>Sample (Average of 3)</u>	Magnesium Oxide % (MgO)				Potassium Oxide % (K2O)			
	6 Months	12 Months	18 Months	24 Months	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	2.852	2.800	2.750	2.837	0.186	0.240	0.163	0.140
No Exposure/Control (B) 1/8"- 1/4"	2.815	2.943	3.043	3.013	0.271	0.357	0.303	0.253
No Exposure/Control (C) 1/4"-3/8"	2.765	2.907	3.350	3.070	0.383	0.437	0.387	0.357
No Exposure/Hycrete (A) 0-1/8"	2.797	2.703	3.157	3.000	0.224	0.253	0.287	0.187
No Exposure/Hycrete (B) 1/8"- 1/4"	2.970	2.707	3.513	3.180	0.374	0.433	0.350	0.323
No Exposure/Hycrete (C) 1/4"-3/8"	3.016	2.690	3.560	3.373	0.454	0.443	0.363	0.433
Above Water Line/Control (A) 0-1/8"	2.710	2.707	2.860	2.920	0.198	0.197	0.157	0.200
Above Water Line/Control (B) 1/8"- 1/4"	2.633	2.663	3.073	3.173	0.305	0.310	0.307	0.350
Above Water Line/Control (C) 1/4"-3/8"	2.661	3.110	3.417	3.330	0.397	0.427	0.460	0.433
Above Water Line/Hycrete (A) 0-1/8"	2.578	2.670	2.957	3.090	0.236	0.233	0.183	0.193
Above Water Line/Hycrete (B) 1/8"- 1/4"	2.699	2.513	3.197	3.407	0.261	0.387	0.340	0.373
Above Water Line/Hycrete (C) 1/4"-3/8"	2.740	2.497	3.447	3.427	0.357	0.423	0.430	0.473
At Water Line/Control (A) 0-1/8"	2.785	2.653	2.927	2.970	0.094	0.160	0.110	0.157
At Water Line/Control (B) 1/8"- 1/4"	2.774	1.677	3.127	3.167	0.220	0.343	0.260	0.357
At Water Line/Control (C) 1/4"-3/8"	2.713	2.767	3.127	3.583	0.359	0.353	0.337	0.497
At Water Line/Hycrete (A) 0-1/8"	2.973	2.857	2.870	3.290	0.142	0.163	0.113	0.213
At Water Line/Hycrete (B) 1/8"- 1/4"	2.754	2.963	3.357	3.540	0.277	0.360	0.293	0.363
At Water Line/Hycrete (C) 1/4"-3/8"	2.759	2.973	3.730	3.567	0.332	0.453	0.427	0.463
Submerged/Control (A) 0-1/8"	2.961	3.007	3.223	3.067	0.099	0.127	0.153	0.170
Submerged/Control (B) 1/8"- 1/4"	2.612	2.723	3.443	3.203	0.255	0.280	0.280	0.253
Submerged/Control (C) 1/4"-3/8"	2.784	3.013	3.647	4.193	0.336	0.367	0.347	0.347
Submerged/Hycrete (A) 0-1/8"	3.135	3.117	3.163	3.150	0.139	0.160	0.120	0.177
Submerged/Hycrete (B) 1/8"- 1/4"	3.055	3.263	3.317	3.310	0.295	0.357	0.260	0.343
Submerged/Hycrete (C) 1/4"-3/8"	2.950	3.220	3.497	3.453	0.342	0.400	0.373	0.453

<u>Sample (Average of 3)</u>	Titanium Dioxide % (TiO ₂)				Sodium Oxide % (Na ₂ O)			
	6 Months	12 Months	18 Months	24 Months	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	0.160	0.157	0.153	0.160	0.051	0.060	0.053	0.047
No Exposure/Control (B) 1/8"- 1/4"	0.149	0.150	0.157	0.160	0.041	0.050	0.043	0.037
No Exposure/Control (C) 1/4"-3/8"	0.141	0.143	0.167	0.167	0.033	0.040	0.043	0.037
No Exposure/Hycrete (A) 0-1/8"	0.159	0.160	0.160	0.183	0.064	0.047	0.057	0.053
No Exposure/Hycrete (B) 1/8"- 1/4"	0.143	0.150	0.167	0.163	0.059	0.040	0.067	0.060
No Exposure/Hycrete (C) 1/4"-3/8"	0.141	0.143	0.167	0.170	0.060	0.037	0.067	0.063
Above Water Line/Control (A) 0-1/8"	0.158	0.160	0.160	0.153	0.051	0.080	0.040	0.040
Above Water Line/Control (B) 1/8"- 1/4"	0.145	0.147	0.160	0.160	0.038	0.033	0.040	0.037
Above Water Line/Control (C) 1/4"-3/8"	0.140	0.137	0.170	0.163	0.037	0.040	0.043	0.040
Above Water Line/Hycrete (A) 0-1/8"	0.156	0.157	0.163	0.163	0.061	0.060	0.057	0.057
Above Water Line/Hycrete (B) 1/8"- 1/4"	0.144	0.147	0.160	0.167	0.051	0.043	0.063	0.060
Above Water Line/Hycrete (C) 1/4"-3/8"	0.142	0.140	0.163	0.173	0.048	0.043	0.067	0.057
At Water Line/Control (A) 0-1/8"	0.153	0.160	0.147	0.157	0.025	0.020	0.027	0.037
At Water Line/Control (B) 1/8"- 1/4"	0.146	0.103	0.153	0.170	0.026	0.010	0.027	0.040
At Water Line/Control (C) 1/4"-3/8"	0.143	0.143	0.157	0.170	0.027	0.023	0.033	0.043
At Water Line/Hycrete (A) 0-1/8"	0.162	0.167	0.140	0.160	0.037	0.037	0.037	0.050
At Water Line/Hycrete (B) 1/8"- 1/4"	0.144	0.150	0.160	0.167	0.036	0.047	0.037	0.050
At Water Line/Hycrete (C) 1/4"-3/8"	0.144	0.147	0.163	0.173	0.041	0.050	0.043	0.050
Submerged/Control (A) 0-1/8"	0.154	0.163	0.150	0.150	0.026	0.027	0.047	0.030
Submerged/Control (B) 1/8"- 1/4"	0.144	0.140	0.153	0.157	0.024	0.020	0.037	0.033
Submerged/Control (C) 1/4"-3/8"	0.148	0.177	0.160	0.163	0.031	0.030	0.037	0.033
Submerged/Hycrete (A) 0-1/8"	0.163	0.153	0.147	0.160	0.036	0.037	0.053	0.050
Submerged/Hycrete (B) 1/8"- 1/4"	0.144	0.147	0.150	0.170	0.035	0.040	0.050	0.047
Submerged/Hycrete (C) 1/4"-3/8"	0.143	0.140	0.160	0.167	0.037	0.037	0.047	0.053

<u>Sample (Average of 3)</u>	Chromium(III) oxide % (Cr ₂ O ₃)				Zinc oxide % (ZnO)			
	6 Months	12 Months	18 Months	24 Months	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	0.194	0.170	0.207	0.140	0.012	0.010	0.010	0.020
No Exposure/Control (B) 1/8"- 1/4"	0.144	0.117	0.130	0.090	0.009	0.010	0.010	0.013
No Exposure/Control (C) 1/4"-3/8"	0.110	0.110	0.113	0.077	0.008	0.010	0.010	0.010
No Exposure/Hycrete (A) 0-1/8"	0.165	0.153	0.133	0.140	0.011	0.017	0.017	0.010
No Exposure/Hycrete (B) 1/8"- 1/4"	0.111	0.107	0.123	0.103	0.009	0.017	0.010	0.010
No Exposure/Hycrete (C) 1/4"-3/8"	0.091	0.103	0.113	0.087	0.008	0.010	0.010	0.010
Above Water Line/Control (A) 0-1/8"	0.167	0.190	0.150	0.133	0.014	0.010	0.010	0.010
Above Water Line/Control (B) 1/8"- 1/4"	0.125	0.133	0.110	0.087	0.009	0.010	0.010	0.010
Above Water Line/Control (C) 1/4"-3/8"	0.101	0.100	0.080	0.077	0.008	0.010	0.010	0.010
Above Water Line/Hycrete (A) 0-1/8"	0.167	0.153	0.140	0.177	0.012	0.010	0.010	0.020
Above Water Line/Hycrete (B) 1/8"- 1/4"	0.150	0.117	0.100	0.093	0.010	0.010	0.010	0.010
Above Water Line/Hycrete (C) 1/4"-3/8"	0.119	0.100	0.087	0.080	0.008	0.010	0.010	0.010
At Water Line/Control (A) 0-1/8"	0.211	0.173	0.173	0.183	0.015	0.010	0.013	0.013
At Water Line/Control (B) 1/8"- 1/4"	0.145	0.077	0.107	0.103	0.010	0.007	0.010	0.010
At Water Line/Control (C) 1/4"-3/8"	0.145	0.110	0.090	0.083	0.008	0.010	0.010	0.010
At Water Line/Hycrete (A) 0-1/8"	0.195	0.177	0.197	0.190	0.015	0.013	0.013	0.013
At Water Line/Hycrete (B) 1/8"- 1/4"	0.129	0.107	0.113	0.110	0.012	0.010	0.010	0.010
At Water Line/Hycrete (C) 1/4"-3/8"	0.108	0.087	0.087	0.093	0.009	0.010	0.010	0.010
Submerged/Control (A) 0-1/8"	0.253	0.203	0.190	0.183	0.016	0.013	0.037	0.017
Submerged/Control (B) 1/8"- 1/4"	0.144	0.120	0.107	0.147	0.010	0.010	0.013	0.013
Submerged/Control (C) 1/4"-3/8"	0.111	0.183	0.083	0.160	0.009	0.010	0.010	0.010
Submerged/Hycrete (A) 0-1/8"	0.217	0.187	0.210	0.223	0.017	0.017	0.017	0.020
Submerged/Hycrete (B) 1/8"- 1/4"	0.132	0.123	0.113	0.127	0.010	0.010	0.010	0.010
Submerged/Hycrete (C) 1/4"-3/8"	0.109	0.103	0.097	0.083	0.009	0.010	0.010	0.010

<u>Sample (Average of 3)</u>	Manganese(II) oxide % (MnO)			
	6 Months	12 Months	18 Months	24 Months
No Exposure/Control (A) 0-1/8"	0.077	0.070	0.070	0.080
No Exposure/Control (B) 1/8"- 1/4"	0.068	0.060	0.070	0.070
No Exposure/Control (C) 1/4"-3/8"	0.060	0.060	0.067	0.070
No Exposure/Hycrete (A) 0-1/8"	0.077	0.077	0.073	0.080
No Exposure/Hycrete (B) 1/8"- 1/4"	0.064	0.063	0.070	0.070
No Exposure/Hycrete (C) 1/4"-3/8"	0.062	0.060	0.073	0.070
Above Water Line/Control (A) 0-1/8"	0.076	0.073	0.077	0.070
Above Water Line/Control (B) 1/8"- 1/4"	0.064	0.063	0.070	0.067
Above Water Line/Control (C) 1/4"-3/8"	0.060	0.057	0.063	0.063
Above Water Line/Hycrete (A) 0-1/8"	0.075	0.070	0.080	0.080
Above Water Line/Hycrete (B) 1/8"- 1/4"	0.068	0.060	0.070	0.070
Above Water Line/Hycrete (C) 1/4"-3/8"	0.064	0.053	0.070	0.070
At Water Line/Control (A) 0-1/8"	0.071	0.070	0.070	0.073
At Water Line/Control (B) 1/8"- 1/4"	0.064	0.037	0.063	0.067
At Water Line/Control (C) 1/4"-3/8"	0.062	0.060	0.067	0.067
At Water Line/Hycrete (A) 0-1/8"	0.073	0.070	0.070	0.077
At Water Line/Hycrete (B) 1/8"- 1/4"	0.065	0.060	0.067	0.070
At Water Line/Hycrete (C) 1/4"-3/8"	0.064	0.060	0.067	0.070
Submerged/Control (A) 0-1/8"	0.079	0.077	0.070	0.063
Submerged/Control (B) 1/8"- 1/4"	0.067	0.060	0.067	0.067
Submerged/Control (C) 1/4"-3/8"	0.064	0.063	0.063	0.070
Submerged/Hycrete (A) 0-1/8"	0.079	0.070	0.077	0.073
Submerged/Hycrete (B) 1/8"- 1/4"	0.065	0.060	0.067	0.070
Submerged/Hycrete (C) 1/4"-3/8"	0.064	0.060	0.070	0.067

REPORT DOCUMENTATION PAGE

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14. ABSTRACT The corrosion of reinforced concrete in wastewater systems is a costly ongoing problem for the Department of Defense (DoD). Capillary action makes concrete vulnerable to penetration by highly corrosive chemicals transported by wastewater. Progressive corrosion of embedded steel reinforcement greatly increases internal stresses on the concrete, ultimately causing premature fractures and spalls. Researchers hypothesized that corrosion in such aggressive environments could be mitigated using a hydrophobic concrete admixture to inhibit penetration of corrosive liquids into wastewater treatment infrastructure, thereby reducing stresses on the materials and extending service life. This study tested and evaluated one such admixture, a patented material called Hycrete. This evaluation exposed test coupons within the sewage effluent system at Fort Detrick, MD. Under the two year duration of this test, the presence of Hycrete had no noticeable influence on performance of concrete exposed to sewer effluent or gasses. Visual appearance did not dramatically differ and there were no significant changes chemical composition. The results suggest that neither the Hycrete nor the reference concrete specimens were affected by chemical leaching or intrusion during the two-year demonstration period. The return on investment for this effort was, therefore, zero.					
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